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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 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. რენტგენოგრამების 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.

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INFLAMMATORY FACTORS IN DISSECTION OF THORACIC AORTIC ANEURYSM

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Abstract.

Background and Aims: In recent years, the prevalence of thoracic aortic aneurysm has increased, and in most cases this pathological condition is diagnosed accidentally. The aim of the current study was to determine the relationship of clinical, laboratory and morphological data with the presence of aorta wall dissection in patients with thoracic aortic aneurysm to reveal factors associated with aorta dissection.

Materials and methods: The following data of 109 patients mean aged of 53 years with thoracic aortic aneurysm (43 patients with aortic dissection) were analyzed: presence/absence of arterial hypertension, indicators of general blood analysis and blood biochemistry, immunomorphological characteristics of the expression of Von Willebrand factor.

Results: Statistically significant differences were found between the incidence of arterial hypertension with respect to the presence or absence of aortic dissection ($p=0.002$), the relationship between the content of lymphocytes ($p=0.021$), segmented neutrophils ($p=0.001$) and the presence of Von Willebrand factor in the medial layer of the aorta, i.e., the prevalence of vasa vasorum ($p=0.018$), with aortic dissection. The average expression area of Willebrand factor in the medial layer of the aorta during dissection was 3.6 (1.5) %, and in patients without aortic dissection – 0.8 (0.3) %.

Conclusion: The results of the study indicate that aortic dissection in patients with thoracic aortic aneurysm is associated with high blood pressure and is accompanied by the development of an inflammatory reaction.

Key words. Thoracic aortic aneurysm, aortic dissection, Von Willebrand factor, inflammation.

Introduction.

Aneurysm and dissection of the thoracic aorta is a cardiovascular disease with early development and rapid progression, with a high probability of fatal complications, which makes it highly relevant to study the pathogenetic mechanisms of the development of aortic dissection in order to develop new diagnostic algorithms and treatment approaches [1]. It is known that the development of aneurysmatic expansion of the aorta in the thoracic region most often has a hereditarily determined character associated with disorders in genomic DNA [2-4]. Genetical predetermined changes in the protein composition and structure of the aortic wall are compensated, and patients can live to a very old age. The threat of rupture of the aortic wall with the development of fatal consequences for the patient is almost unpredictable. There are clinical studies

that show an increased threat of aneurysm dissection in patients with arterial hypertension and a number of other concomitant pathologies [5]. According to the results of morphological studies of postoperative material, we have previously shown that aortic rupture is not an instantaneous catastrophe, but a rather long process accompanied by a reaction of the vessels supplying the aorta, inflammatory infiltration in the adventitia and medial aortic membrane with a pronounced macrophage reaction [6,7]. The article presents the results of the analysis of clinical laboratory and morphological data of patients with thoracic aortic aneurysm and their association with the presence of aorta dissection.

Materials and Methods.

The study was performed in accordance with the Declaration of Helsinki and approved by the local Ethics Committee of the Petrovsky National Research Center of Surgery (Approval No.3, 17 March 2022). The study conducted a retrospective analysis of clinical and morphological data of 109 patients with thoracic aortic aneurysm with and without aortic dissection.

The following characteristics of study participants were analyzed: presence of arterial hypertension and coronary heart disease, aneurysm diameter, indicators of blood general analysis and blood biochemistry (C-reactive protein (CRP) and bilirubin level, number of erythrocytes, leukocytes, percentage of eosinophils, neutrophils, lymphocytes, monocytes, platelet count, erythrocyte sedimentation rate (ESR) were assessed by standard laboratory procedures). The expression of the von Willebrand factor (a marker of the endothelium and, accordingly, vessels) in various layers of the aortic wall was evaluated with immunomorphological methods.

The segments of the aortic aneurysm wall were obtained during the operation of prosthetics of the aortic aneurysm. Aortic segments removed from patients were immediately fixed in 10% formalin. Then the fixed segments of the aortic aneurysm were treated according to the generally accepted method and poured into paraffin. The sections were examined using antibodies to the von Willebrand factor (Sigma Immuno-Chemicals, USA). Antibodies were visualized using an immunoperoxidase reaction in the Ventana immunostainer (Roche, USA) using an immunoperoxidase reaction according to a generally accepted technique. Morphometric studies were carried out using a Scan Scope device from Leica, Germany with the Image Scope morphometric program (Leicamycrosystems CMS GmbH, Austria). The number of vasa vasorum was calculated on an area of 495 μm^2 at magnification $\times 400$ in six different, randomly

selected fields of view (in 6 fields of view in the media slice and in 6 fields of view in adventitia) using the Scan Scope tool using the Image Scope morphometric program. In order to obtain the most objective data, all calculations of vasa vasorum were carried out by two researchers independently of each other.

Data processing was performed using the R programming language in the R Studio environment (version 1.2.5042, R Studio, Inc.) [8]. Descriptive statistics, statistical hypothesis testing, and linear modeling were carried out using a basic set of R functions. The Kolmogorov-Smirnov test was used as a statistical test of the normal distribution of quantities in the Lilliefors modification. The Fligner-Kiln test and the Barlett test were used to assess the uniformity of variances of quantities. Emissions were determined using the Bonferroni test. Comparative analysis of averages was carried out by the Kruskal-Wallis test. For nominal variables, conjugacy tables were compiled, the relationship of variables in which was established using an accurate Fisher test. The correlation between the variables was determined using the Spearman coefficient. For all statistical tests, the probability of making a mistake of the first kind was assumed to be equal to or less than 5%, and confidence intervals were determined in the range of 95%.

Results.

Totally 109 participants were included in the study. The average age of patients was 53 years, from 18 to 79, 72% male participants: 77% of patients with arterial hypertension. The patients were included in 2 groups: with aorta dissection (n=43) and without dissection (n=66). The clinical and laboratory characteristics of study participants are presented in Table 1.

The relationship between quantitative variables and the presence or absence of aortic dissection was investigated using conjugacy tables. As a result, statistically significant differences were found between the incidence of arterial hypertension with respect to the presence or absence of aortic dissection (p=0.002). A comparative analysis of these differences is presented at Figure 1.

Table 1. Clinical and laboratory characteristics of study participants.

Characteristics	No dissection (n=66)	Dissection (n=43)	Significance, p
Age, years	55 (13)	50 (10)	0.050
Aneurysm diameter, mm	58 (11)	57 (9)	0.935
Hypertension, %	71	93	0.002*
CHD, %	34	44	0.287
Blood leukocytes, 10 ⁹ /l	9.4 (3.7)	9.4 (4.6)	0.998
Segmented neutrophils, %	59 (11)	66 (10)	0.001*
Lymphocytes, %	23 (13)	17 (12)	0.021*
ESR, mm/h	19 (13)	23 (15)	0.151
CRP, mg/l	52 (43)	60 (56)	0.587
Expression of vWF in media, %	0.8 (0.3)	3.6 (1.5)	0.018*
Expression of vWF in adventitia, %	4.5 (1.4)	6.5 (2.6)	0.127

CHD: coronary heart disease; CRP: C-reactive protein; ESR: Erythrocyte sedimentation rate; Vwf: von Willebrand factor.

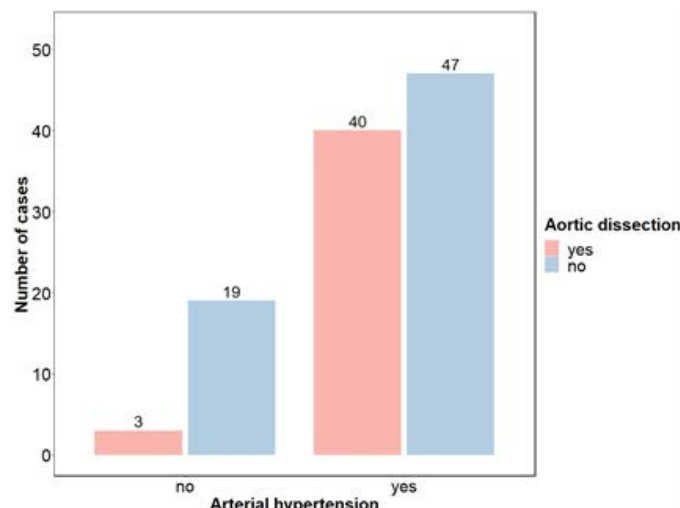


Figure 1. Comparative analysis of cases of arterial hypertension regarding the presence of aortic dissection based on Fischer test.

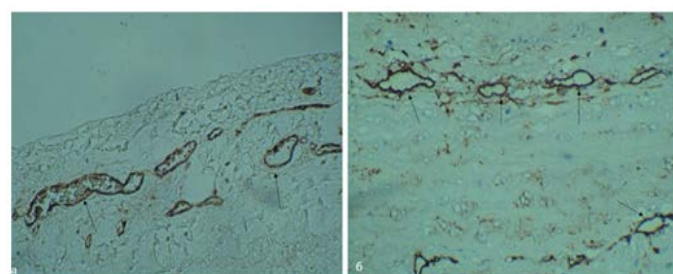


Figure 2. Thoracic aortic aneurysm. a) Brown coloration of the Vasa vasorum endothelium in the adventitia of the vessel. Antibodies to the von Willebrand factor. Immunoperoxidase reaction. Cell nuclei are stained with hematoxylin, x200; b) formed Vasa vasorum in the medial membrane of the aortic aneurysm. Antibodies to the von Willebrand factor. Immunoperoxidase reaction. The cell nuclei are stained with hematoxylin, x400.

As for the relationship of quantitative variables with cases of aortic dissection, the relationship between the content of lymphocytes, segmented neutrophils and the presence of von Willebrand factor in the medial layer of the aorta, i.e., the prevalence of vasa vasorum, with cases of aorta dissection was revealed. The results of a comparative analysis of the level of lymphocytes demonstrate significant decrease of lymphocyte count in aortic dissection: in a subgroup of patients with dissection, p=0.021, which is 26% less than in the group of patients without dissection. At the same time, the results of a comparative analysis of the level of segmented neutrophils demonstrate a significant increase of neutrophils count in aortic dissection in a subgroup of patients with dissection, p=0.001, which is 12% more than in the group of patients without dissection.

Figure 2 presents the immunomorphological examination of the aortic wall with an endothelial marker (von Willebrand factor). With a pronounced inflammatory re-action, the ingrowth of newly formed vessels into the medial layer of the aorta is demonstrated, which is confirmed by morphometric data.

The results of a comparative analysis of the expression area of von Willebrand factor in the medial layer of the aorta, which reflects the presence of vasa vasorum shows a significant

increase of vasa vasorum in samples of aortic dissection. The average level of von Willebrand factor expression was 3.6 (1.5) % in dissection samples, and 0.8 (0.3) % in patients without aortic dissection, $p=0.018$ (Figure 3). Expression of von Willebrand factor in adventitia was also higher in samples of patients with dissection, but this difference didn't reach statistical significance.

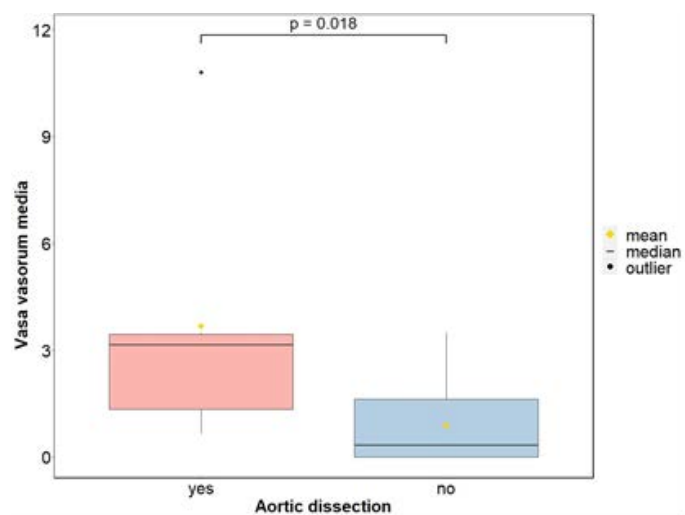


Figure 3. Comparative analysis of the level of von Willebrand factor in the media layer of aorta for cases of presence or absence of aortic dissection in accordance with the Kruskal-Wallis test.

All other qualitative and/or quantitative variables were checked for their association with aortic dissection. Despite the fact that there is some correlation between the variables, no other statistically significant association of any parameters including CRP level and ESR with aortic dissection was found.

Discussion.

Timely diagnosis of a thoracic aneurysm and subsequent dynamic monitoring of patients is a basic element of prevention of life-threatening events, such as aortic dissection and rupture. Regardless of the etiology and localization of the aneurysm in the thoracic aorta, patients develop morphological changes in the medial layer of the vessel. Changes in the media of the aorta at some point become critical, that lead to a violation of the sealing of the thoracic aorta and rupture of the aneurysm [9-11].

The aneurysmally expanded area of the aorta is constantly affected by systemic arterial pressure. Therefore, the presence or absence of arterial hypertension in patients with thoracic aneurysm may serve as a risk factor for aortic rupture. In this study, we conducted an analysis of the incidence of hypertension with respect to the presence or absence of aortic dissection. The results indicate a higher incidence of aneurysm dissection in the group of patients with arterial hypertension. Thus, the presence of arterial hypertension should be taken into account in order to conduct additional diagnostic methods and clarify the risk stratification in patients with thoracic aortic aneurysm.

The conducted studies demonstrate the involvement of an inflammatory reaction in morphological changes in the aortic wall. It was shown that inflammation is involved in the pathogenesis of aortic aneurysm by migration of T-lymphocytes

and macrophages into the medial layer of the vessel. It has also been found that some cytokines and chemokines (TNF- α , interferon- γ , IL-1, IL-2, IL-6 and IL-8) are activated and contribute to the attraction of other inflammatory cells into the aortic wall [12-14]. In the study, we identified a population of immunological cells, the level of which is increased in patients with thoracic aneurysm dissection. Comparative analysis of the level of lymphocytes in the blood formula in cases of presence or absence of aortic dissection showed a decrease in lymphocytes in the group of patients with aortic dissection. Such a decrease in lymphocytes may be associated with the migration of these cells into the adventitia and medial membrane, so in these patients we found infiltrates from T cells in the wall of the aortic aneurysm. It can be assumed that the bone marrow does not have time to react to a decrease in the number of these cells in the blood.

Moreover, we found a relative increase in the level of segmented neutrophils in the blood formula in patients with aorta dissection. Thus, the average level of segmented neutrophils in the blood formula was higher than the level of similar cells in patients without aorta dissection. These data may indirectly indicate inflammation of the aneurysm wall and the possible involvement of latent bacterial infection in the development of an inflammatory reaction and the initiation of dissection of the aortic wall. Since the study was performed on a significant number of patients (the aorta samples of 109 patients were used for analysis), with an adequate mathematical analysis of the obtained data, it should be recognized that the connection of aortic aneurysm dissection with an increase in the percentage of segmented neutrophils in the blood is natural. In addition, the material for the study was taken during an operation carried out as planned, i.e., there were no symptoms of the presence of an acute inflammatory process before patients were operated on.

A number of recent studies have demonstrated the possible role of von Willebrand factor in the pathogenesis of aortic aneurysms [15,16]. In our study, we found a statistically significant change in expression of von Willebrand factor in the aortic media among patients with thoracic aneurysm dissection. Comparative analysis of the level of von Willebrand factor in the media for cases of the presence or absence of aortic dissection has demonstrated that in the group of patients with aneurysm dissection, the average level of the von Willebrand factor was more than four times higher than in patients without the dissection of aorta aneurysm. The influence of the von Willebrand factor on the frequency of aortic dissection is probably associated with fenestration of the vascular wall. In response to the violation of the integrity of the aortic wall, there is an activation of factors of the hemostasis system, which is the von Willebrand factor. Thus, an increase in the activity of the factor may reflect the dynamics of structural transformations of the vascular wall during dissection of the thoracic aortic aneurysm.

The results of our study demonstrate statistically significant changes in immunological parameters in patients with thoracic aortic aneurysm. In the study, we were able to identify and characterize the population of immunological cells, the level of which is increased in patients with aortic aneurysm dissection. The identified immunological indicators may have diagnostic value and be used to clarify the risk stratification in patients with

thoracic aorta aneurysm. It should be noted that in this study we were unable to identify a significant association of the level of lymphocytes, segmented neutrophils and expression of the von Willebrand factor in the media layer of aorta with arterial hypertension in patients with aortic dissection. Consequently, this fact suggests a certain independence of the pathogenetic pathways of a thoracic aneurysm under the action of arterial hypertension and an inflammatory reaction in the aortic wall.

Conclusion.

The data obtained demonstrate that dissection of the thoracic aortic aneurysm most often occurs in patients with high blood pressure and proceeds through the development of an inflammatory reaction with neoplasm of the vessels of the aortic wall and their germination into the medial membrane, where normally vessels are extremely rare. The inflammatory reaction is accompanied by an increase in the ratio of lymphocytes to segmented neutrophils in the blood formula. The appearance of de-scribed changes will help the physicians to speed up the preparation for a surgical treatment of an aortic aneurysm, especially if it occurs in patients with arterial hypertension.

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Ethics Approval and Consent to Participate.

The study was performed in accordance with the Declaration of Helsinki and approved by the local Ethics Committee of the Petrovsky National Research Center of Surgery. Ethics Approval and Consent to Participate. Informed consent was obtained from all subjects involved in the study.

Data Availability.

Data are available from the corresponding author upon request.

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Conflicts of Interest.

The authors declare no conflict of interest.

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