

# GEORGIAN MEDICAL NEWS

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ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии  
საქართველოს სამედიცინო სიახლენი

## GEORGIAN MEDICAL NEWS

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

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

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

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

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

## WEBSITE

[www.geomednews.com](http://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](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.nlm.nih.gov/bsd/uniform_requirements.html)  
[http://www.icmje.org/urm\\_full.pdf](http://www.icmje.org/urm_full.pdf)

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

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

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

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

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

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

## ავტორთა საყურადღებო!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დავიცვათ შემდეგი წესები:

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

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

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

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

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

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრაფიის ფოტოსურათები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შედეგების ან იმპრეგნაციის მეთოდი და აღნიშნოთ სურათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხოური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიღრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამულო, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი, წელი, ჟურნალის №, პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფხიხლებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიღრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანელის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა, მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა, რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შეჯერება ხდება საავტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

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## EFFICACY AND PROGNOSIS OF ANTI-VEGF AGENTS COMBINED WITH PANRETINAL PHOTOCOAGULATION IN DIABETIC RETINOPATHY: A CLINICAL OBSERVATIONAL STUDY

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### Abstract.

Diabetic retinopathy (DR) remains a leading global cause of blindness, significantly affecting the quality of life of patients with diabetes. This clinical observational study was designed to comprehensively assess the synergistic effects of anti-vascular endothelial growth factor (anti-VEGF) drugs and panretinal photocoagulation (PRP) on the progression of DR and visual outcomes. A total of 120 patients with severe non-proliferative or proliferative DR were prospectively recruited and randomly assigned into two groups: the combination therapy group (anti-VEGF + PRP) and the PRP monotherapy group. The results clearly demonstrated that the combination group achieved remarkable anatomical and functional improvements, with a more substantial reduction in macular edema and neovascularization. Long-term follow-up over 24 months further revealed better visual acuity retention and a lower incidence of complications in the combination group. These findings strongly support the integration of anti-VEGF agents into traditional PRP protocols for the effective management of advanced DR.

**Key words.** Diabetic retinopathy, anti-VEGF, panretinal photocoagulation, prognosis, macular edema.

### Introduction.

Diabetes mellitus has become a worldwide epidemic, with an ever-increasing number of patients. Diabetic retinopathy (DR), as one of the most common and severe microvascular complications of diabetes, affects more than 30% of diabetic patients [1]. DR is characterized by a series of pathological changes, including microvascular damage, ischemia, and pathological angiogenesis [1]. These changes can gradually lead to visual impairment and even blindness if left untreated.

Panretinal photocoagulation (PRP) has long been a cornerstone in the treatment of proliferative DR (PDR). By applying laser burns to the peripheral retina, PRP aims to reduce the oxygen demand of the retina, thereby alleviating the ischemic state and inhibiting the formation of new blood vessels [2]. However, PRP is not without its limitations. In some cases, it may exacerbate macular edema, leading to further deterioration of central vision. Additionally, the laser treatment may cause loss of peripheral vision, which can also impact patients' daily activities and quality of life [2].

In recent years, the emergence of anti-VEGF agents has brought new hope to the treatment of DR. Drugs such as ranibizumab and aflibercept can specifically target VEGF, a key factor driving vascular leakage and neovascularization in DR [3-11]. By blocking the VEGF signaling pathway, anti-VEGF agents can effectively reduce vascular permeability and inhibit

the growth of new blood vessels, thus improving the symptoms of DR [3,12-15]. However, the long-term effects of anti-VEGF monotherapy and its optimal combination with other treatment modalities remain to be further explored [8-11,16].

This study is thus aimed at investigating whether the combination of anti-VEGF agents and PRP can enhance the therapeutic efficacy while minimizing adverse outcomes. By comparing the two treatment groups, we hope to provide more evidence-based treatment options for patients with advanced DR [5,17].

### Materials and Methods.

#### Study design:

This was a 24-month prospective observational study conducted at a tertiary ophthalmology center from 2023 to 2025. The study protocol was approved by the institutional review board, and all participants provided written informed consent prior to enrollment.

#### Participants:

A total of 120 adults with type 2 diabetes were recruited. The inclusion criteria were HbA1c  $\leq 9\%$  and a diagnosis of severe non-proliferative diabetic retinopathy (NPDR) or proliferative diabetic retinopathy (PDR). Exclusion criteria included previous PRP/anti-VEGF treatment, significant media opacity that could affect the assessment of retinal conditions, and other eye diseases that might interfere with the study results.

#### Interventions:

**Combination group:** Patients in this group received intravitreal injection of aflibercept at a dose of 2 mg monthly for 3 consecutive months. After the third injection, panretinal photocoagulation (PRP) was performed using a 532 nm argon laser. The PRP treatment consisted of 1,200 - 1,600 burns, evenly distributed in the peripheral retina.

**PRP group:** Patients in this group received only standard PRP treatment. The parameters of the PRP were the same as those in the combination group.

#### Outcome Measures:

**Best-corrected visual acuity (BCVA, measured by ETDRS chart):** BCVA was measured at baseline, 3 months, 6 months, 12 months, 18 months, and 24 months after the start of treatment. The ETDRS chart was used to ensure accurate and standardized measurement of visual acuity [3,4,6,9,10,13-15].

**Central macular thickness (CMT, measured by OCT):** Optical coherence tomography (OCT) was performed at the same time points as BCVA measurement to assess the changes

in central macular thickness. CMT is an important indicator of macular edema [3,4,9,10,17].

**Regression of neovascularization (assessed by fundus fluorescein angiography):** Fundus fluorescein angiography was carried out at baseline and 12 months after treatment to evaluate the regression of neovascularization. The degree of neovascularization was graded according to standard criteria [2-5,16,17].

**Adverse events (such as vitreous hemorrhage, macular atrophy, etc.):** All adverse events that occurred during the treatment period were carefully recorded. Special attention was paid to vitreous hemorrhage and macular atrophy, as these are common and serious complications in DR treatment [2,3,5,16]. To present the information related to the research methods more clearly, the following tables are created (Tables 1 and 2).

**Table 1.** The information related to the research methods.

Group	Details of Interventions
Combination group	Intravitreal injection of aflibercept (2 mg monthly for 3 times) first. Then, PRP was conducted with 1,200 - 1,600 burns using a 532 nm argon laser. The PRP treatment was started after the third aflibercept injection.
PRP group	Standard PRP treatment only. The PRP parameters were the same as those in the combination group, with 1,200 - 1,600 burns using a 532 nm argon laser.

**Table 2.** Outcome Measures and Measurement Methods.

Outcome Measures	Measurement Methods
Best-corrected visual acuity (BCVA)	Measured using the ETDRS chart at baseline, 3 months, 6 months, 12 months, 18 months, and 24 months after treatment start.
Central macular thickness (CMT)	Measured by OCT at the same time points as BCVA measurement.
Regression of neovascularization	Assessed by fundus fluorescein angiography at baseline and 12 months after treatment. The degree of neovascularization was graded according to standard criteria.
Adverse events	Recorded throughout the treatment period. Special attention was paid to vitreous hemorrhage, macular atrophy, and other common and serious complications.

### Statistical Analysis.

Analysis of variance (ANOVA) was used to compare the differences in continuous variables between the two groups, such as BCVA and CMT. Kaplan-Meier survival curves were employed to analyze the incidence of complications over time. All statistical analyses were performed using SPSS v26 software, and a p-value < 0.05 was considered statistically significant.

### Results.

**BCVA:** At 12 months, the combination group showed a mean improvement of 8.2 letters, while the PRP group only improved by 2.1 letters (p<0.001). The improvement in the combination group was maintained throughout the 24-month follow-up period [4,6].

**CMT:** The central macular thickness in the combination group decreased by 152  $\mu$ m, compared with a decrease of 48  $\mu$ m in the PRP monotherapy group (p = 0.002). The combination group also showed a more stable reduction in CMT over time.

**Regression of neovascularization:** 87% of patients in the combination group achieved complete regression of neovascularization, while the proportion in the PRP group was 62% (p = 0.01). The combination therapy was more effective in inhibiting the recurrence of neovascularization.

**Complications:** The combination group had a lower incidence of vitreous hemorrhage (9% vs. 24%) and tractional retinal detachment (2% vs. 11%). The Kaplan-Meier survival curves also showed that the time to the occurrence of complications was significantly longer in the combination group (Table 3).

**Table 3.** The results of related study are presented.

Group	Combination group	PRP group
BCVA Improvement (Number of Letters)	8.2	2.1
CMT Reduction ( $\mu$ m)	152	48
Complete Regression Rate of Neovascularization (%)	87	62
Incidence of Vitreous Hemorrhage (%)	9	24
Incidence of Tractional Retinal Detachment (%)	2	11

### Discussion.

The combination therapy in this study effectively combines the rapid suppression of VEGF by anti-VEGF agents and the long-term ischemic control of PRP. Anti-VEGF agents can quickly reduce vascular leakage and inhibit the growth of new blood vessels, while PRP can address the underlying ischemic problem in the long term, thus effectively dealing with both edema and neovascularization [5].

The 8.2-letter improvement in BCVA in the combination group is consistent with the results of the Protocol S trial [6]. However, this study extends the findings to a real-world cohort with stricter glycemic control, which may better reflect the actual situation of patients in clinical practice [6]. The significant reduction in macular edema in the combination group may delay or even avoid the need for vitrectomy, which is a more invasive treatment option [3,5,10,17].

Nevertheless, this study has some limitations. The 24-month follow-up period may not be sufficient to fully assess the long-term effects and potential late complications. For example, the risk of late macular atrophy, which may be associated with long-term use of anti-VEGF drugs or repeated PRP treatments, still needs to be investigated in future studies with longer follow-up [3,5].

In addition, the potential risks associated with long-term use of anti-VEGF drugs, such as increased susceptibility to infections and systemic side effects, also require further exploration [3]. The impact of PRP on peripheral retinal function, such as color vision and contrast sensitivity, also deserves more in-depth research [2].

## Conclusion.

The anti-VEGF-PRP combination therapy significantly improves anatomical and functional outcomes in advanced DR, with fewer complications than PRP alone. This approach has the potential to redefine the first-line treatment strategy for vision-threatening DR.

Future research should focus on further expanding the sample size to enhance the statistical power of the study. Long-term follow-up studies are needed to comprehensively evaluate the long-term safety and efficacy of the combination therapy. Exploring the optimal treatment regimen for the combination of different anti-VEGF drugs and PRP, as well as investigating the efficacy differences of combination therapy in different subtypes of DR patients, will provide more evidence for the precise treatment of DR.

## Availability of Data and Materials.

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

## Ethics Approval and Consent to Participate:

Ethical approval was obtained from Qingdao Jiaozhou Central Hospital Ethics Committee; consent was obtained from all participants.

## Funding:

Not application.

## Conflict of interest:

The authors declare no conflicts of interest statement.

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