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ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии
საქართველოს სამედიცინო სიახლენი

GEORGIAN MEDICAL NEWS

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

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

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

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

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

WEBSITE

www.geomednews.com

К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

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

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

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

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

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

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

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

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

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

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

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

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

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

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

При нарушении указанных правил статьи не рассматриваются.

REQUIREMENTS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

ავტორთა საყურადღებო!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დავიცვათ შემდეგი წესები:

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

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

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

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

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

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

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

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

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

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

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

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

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

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CRITICAL VALUES OF HEMOSTASIS PARAMETERS IN AN ONCOLOGY CENTER: A RETROSPECTIVE REGISTRY-BASED STUDY

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Abstract.

Background and Objectives: Patients with cancer are at high risk of hemostatic disorders due to tumor-related mechanisms, antineoplastic therapy, and surgical interventions. Critical laboratory values (CVs) represent life-threatening conditions requiring immediate clinical response and are essential indicators of laboratory quality and patient safety.

Objective: To analyze the frequency, structure, and distribution of critical values of hemostasis parameters (APTT and fibrinogen) in the clinical diagnostic laboratory of an oncology center.

Materials and Methods: A retrospective study of the electronic CV registry was conducted for the period January–December 2025. Critical thresholds were defined according to SOPs and international recommendations. Data were analyzed by month, clinical ward, and type of hemostatic disorder. Comparative statistical analysis using the χ^2 test was performed. During the study period, a total of 48,326 coagulation tests were performed, including 27,418 APTT assays and 20,908 fibrinogen measurements. The overall frequency of critical values was 27.5 per 1,000 coagulation tests.

Results: A total of 1,328 CVs were registered. The most frequent abnormalities were hypofibrinogenemia (<1.5 g/L) (60%), prolonged APTT (>78 s) (23%), and absent clot formation by APTT (10%). The distribution of CVs differed significantly across clinical departments ($\chi^2(13) = 726.51$, $p < 0.001$), with the highest burden observed in the hematobiochemistry department, ICU, and hematology wards. Extreme hypocoagulatory states (absence of clot formation by APTT or fibrinogen assays) accounted for 12% of all registered critical events, indicating a substantial proportion of patients at immediate risk of life-threatening hemorrhagic complications. Seasonal variation was statistically significant ($\chi^2(10) = 72.80$, $p < 0.001$), with peaks in March, July, and October.

Conclusions: Critical hemostasis abnormalities are highly prevalent in oncology patients and are predominantly associated with hypocoagulatory states. Implementation of a structured electronic CV reporting system enables rapid clinician notification, optimization of laboratory workflow, and improved patient safety in high-risk oncology settings.

Key words. Critical values, APTT, fibrinogen, hemostasis, coagulopathy, patients with cancer, patient safety.

Introduction.

The hemostasis system plays a critical role in maintaining the vital functions of the organism. Disturbances of coagulation balance – both hypocoagulatory and hypercoagulatory – can lead to hemorrhagic complications and thromboembolic events,

which are among the leading causes of morbidity and mortality in patients with cancer [1,2].

The concept of critical laboratory values was introduced by G.D. Lundberg in 1972. A critical value is defined as a laboratory result that reflects a pathophysiological state deviating so far from normal that it poses an immediate life-threatening risk and requires urgent clinical intervention [3,4]. This concept has since been universally adopted and is enshrined in the international standard ISO 15189:2022, which mandates that every accredited laboratory maintain an approved list of CVs and a documented procedure for their timely communication [5].

Critical values constitute the post-analytical phase of the laboratory process and imply urgent notification of the attending physician. Failure to report CVs promptly – or miscommunication during their transfer – is recognized as a significant contributor to preventable adverse outcomes. Each laboratory is therefore required to have a standardized operating procedure (SOP) governing the communication of critical results [5,6].

Monitoring hemostasis parameters is of particular importance in patients with cancer, who frequently present with disseminated intravascular coagulation (DIC), consumption coagulopathy, complications of anticoagulant and antitumor therapy, postoperative hemorrhage, and coagulation disorders associated with sepsis or hepatic insufficiency. The prevalence of hemostasis abnormalities in this population is substantially higher than in the general hospital population, making the CDL a central actor in patient safety [1,7].

The most informative screening parameters of the hemostasis system are activated partial thromboplastin time (APTT), which reflects the integrity of the intrinsic coagulation pathway, and fibrinogen concentration – the substrate of the terminal stage of the coagulation cascade and a key acute-phase reactant [8,9].

Despite the recognized importance of critical laboratory values in oncology practice, data regarding the epidemiology and institutional distribution of critical hemostasis abnormalities remain limited, particularly in Central Asian healthcare systems. Most available studies focus on general hospital populations, whereas oncology centers represent a unique high-risk environment characterized by intensive chemotherapy, invasive procedures, severe infections, and profound treatment-associated cytopenias. Therefore, evaluation of institutional patterns of critical hemostasis values may provide important information for optimization of laboratory quality management and patient safety strategies.

Study objective: to conduct a retrospective analysis of CVs of hemostasis parameters (APTT and fibrinogen) in the CDL of an

oncology center for 2025, with assessment of their distribution by month, clinical ward, and type of hemostatic disorder.

To our knowledge, this is the first comprehensive registry-based analysis of critical hemostasis values in a specialized oncology center in Kazakhstan, including assessment of seasonal patterns and departmental distribution.

Materials and Methods.

A retrospective analysis of the electronic critical value registration log of the CDL of the National Research Oncology Center (Astana, Republic of Kazakhstan) was conducted for the period January–December 2025. The data source was an electronic CV log accessible to all CDL staff at their workstations in real time. At the end of each reporting month, data were transferred to a paper archive by the quality manager and verified for completeness.

Inclusion criterion: all CV episodes registered in the log during 2025. Exclusion criterion: duplicate registration of the same result due to a technical error, identified and removed by manual cross-check against the laboratory information system. After deduplication, the final analytical sample comprised 1,328 CV episodes. During the study period, the laboratory processed 48,326 coagulation assays, including 27,418 APTT tests and 20,908 fibrinogen measurements. The incidence of critical values was therefore calculated at 27.5 per 1,000 coagulation tests.

Two hemostasis parameters with pre-established CV thresholds were analyzed (Table 1). Critical thresholds were defined in accordance with the internal SOP «Rules for Verbal and Telephone Communication of Critical Results» and agreed with the heads of clinical departments. The thresholds correspond to ranges recommended in peer-reviewed international literature and are aligned with IFCC and EFLM guidance [6,10,11].

APTT was determined by the clot-based (optical) method on an automated coagulation analyzer using standardized lyophilized reagents. Fibrinogen was quantified by the functional von Clauss method. Both methods are internationally validated and routinely recommended for coagulation screening [8]. Daily internal quality control (IQC) was performed using two-level liquid control materials; all IQC results were within ± 2 SD of the target values throughout the study period. All coagulation analyses were performed in accordance with ISO 15189:2022 laboratory quality standards. Critical values were communicated immediately to the responsible clinical staff via telephone notification and documented in the electronic registry according to institutional policy. The median notification time did not exceed 15 minutes from analytical validation.

Data were analyzed by month of registration, clinical ward, and type of hemostatic disorder (six categories).

To reduce the risk of duplicate registration, all critical events underwent manual verification against the laboratory information system by the quality manager. Cases with repeated measurements from the same patient within a short analytical interval were reviewed individually and counted as a single clinical episode unless associated with a documented change in clinical status. Data were extracted from the electronic registry in January 2026 for the full calendar year 2025. Because the electronic critical value registry was implemented in the middle

of January 2025, the January dataset was considered incomplete and was therefore excluded from the chi-square analysis of seasonal variation to minimize potential statistical bias.

Statistical analysis included descriptive statistics and comparative analysis using the χ^2 (chi-square) test. A p-value < 0.05 was considered statistically significant.

Results.

A total of 1,328 critical values of hemostasis parameters were registered in the CDL of the oncology center during the study period (January–December 2025).

1. Monthly distribution of critical values.

The monthly distribution of CVs is presented in Table 2 and Figure 1.

The highest number of CVs was recorded in October (167; 12.6%), March (152; 11.4%), and July (149; 11.2%), collectively accounting for 35.2% of the annual total. The minimum was observed in January (5; 0.4%), which is attributable to incomplete data capture during the initial two weeks following the rollout of the new electronic log. Excluding January, the mean monthly CV count was 120 (range: 75–167). Accordingly, January data were excluded from the comparative chi-square analysis of seasonal variation.

Three distinct seasonal peaks are apparent: late winter/early spring (March), midsummer (July), and autumn (October). These peaks coincide with high-volume periods for elective surgical admissions and intensified chemotherapy cycles at the institution, suggesting a direct link between clinical activity and CV burden. Seasonal variation in CV frequency was statistically significant ($\chi^2(10) = 72.80$, $p < 0.001$), suggesting that fluctuations in critical values are associated with institutional clinical workload patterns.

2. Distribution of critical values by clinical ward.

The distribution of CVs across clinical wards is presented in Table 3 and Figure 2.

The largest number of registered CVs was associated with the hematology processing unit (GBKh: 221; 17.5%), which centrally receives coagulation samples from multiple inpatient departments across the oncology center. Among direct clinical wards, the highest burden was observed in the intensive care unit (TSARIT: 181; 14.4%), oncologic surgery department (OGR: 169; 13.4%), and hematology wards GEM-1 (166; 13.2%) and GEM-2 (139; 11.0%). Together, these five units accounted for 876 CVs (65.9% of the annual total), highlighting a pronounced concentration of critical hemostasis events in high-risk clinical settings.

A statistically significant difference in the distribution of CVs across clinical wards was observed ($\chi^2(13) = 726.51$, $p < 0.001$), indicating a non-random concentration of critical values in departments managing patients with severe clinical conditions.

The leading position of GBKh reflects its role as the primary processing unit for all coagulation samples from inpatients across the center. The high proportion of CVs in the intensive care unit is consistent with the severity of patients' clinical status. The substantial CV burden in hematology wards (GEM-1 + GEM-2 combined: 305; 23.0%) reflects the inherent coagulopathy of oncohematological diseases and the myelosuppressive effects of intensive chemotherapy regimens.

Table 1. Critical value thresholds for hemostasis parameters adopted in the CDL of the National Research Oncology Center.

Parameter	Lower critical threshold	Upper critical threshold	Reference interval
APTT (s)	< 19	> 78	24-36
Fibrinogen (g/L)	< 1.5	> 8.0	2.0-4.0

Note: APTT – activated partial thromboplastin time; CDL – clinical diagnostic laboratory. Reference intervals correspond to the manufacturer's reagent specifications and are consistent with EFLM reference values for adults.

Table 2. Monthly distribution of critical values of hemostasis parameters, 2025 (n = 1,328).

Month	Number of CVs (abs.)	Share (%)
January	5	0.4
February	126	9.5
March	152	11.4
April	132	9.9
May	113	8.5
June	84	6.3
July	149	11.2
August	75	5.6
September	107	8.1
October	167	12.6
November	90	6.8
December	128	9.6
Total	1328	100.0

Note: Absolute count (n) and percentage share (%) of total CVs per month. January data reflect partial coverage owing to the mid-month launch of the electronic log.

Table 3. Distribution of critical values of hemostasis parameters by clinical ward, 2025 (n = 1,328).

Ward	Number of CVs (abs.)	Share (%)
GBKh	221	17.5
TSARIT	181	14.4
OGR	169	13.4
GEM-1	166	13.2
GEM-2	139	11.0
COO	86	6.8
KDC	69	5.5
MPO	54	4.3
TsMPKh	54	4.3
TsKhTIR	46	3.7
TKM	26	2.1
TsMTer	26	2.1
Oper/BL	15	1.2
TsSKh	8	0.6
Total	1328	100.0

Abbreviations: GBKh – hematobiochemistry department; TSARIT – ICU; OGR – general surgery oncology; GEM-1/GEM-2 – hematology wards 1 and 2; COO – oncology center; KDC – clinical diagnostic center; MPO – medical oncology; TsHMPKh – minimally invasive surgery; TsKhTIR – chemotherapy and immunotherapy; TKM – bone marrow transplantation; TsMTer – molecular therapy; Oper/BL – operating/bone marrow block; TsSKh – cardiovascular surgery.

Table 4. Structure of critical values by type of hemostatic disorder, 2025 (n = 1,328).

Type of hemostatic disorder	Count (abs.)	Share (%)
Fibrinogen reduction < 1.5 g/L	797	60
APTT prolongation > 78 s	305	23
APTT - no coagulation	133	10
APTT shortening < 19 s (hypercoagulation)	66	5
Fibrinogen - no coagulation	27	2
Combined critical values (APTT + fibrinogen)	48	3.6
Unclassified / incomplete registry data	20	1.5
Total	1328	100

Note: The category “Combined critical values” includes episodes in which critical abnormalities of both APTT and fibrinogen were registered simultaneously within the same clinical event. “Unclassified / incomplete registry data” includes cases with incomplete disorder classification in the electronic registry.

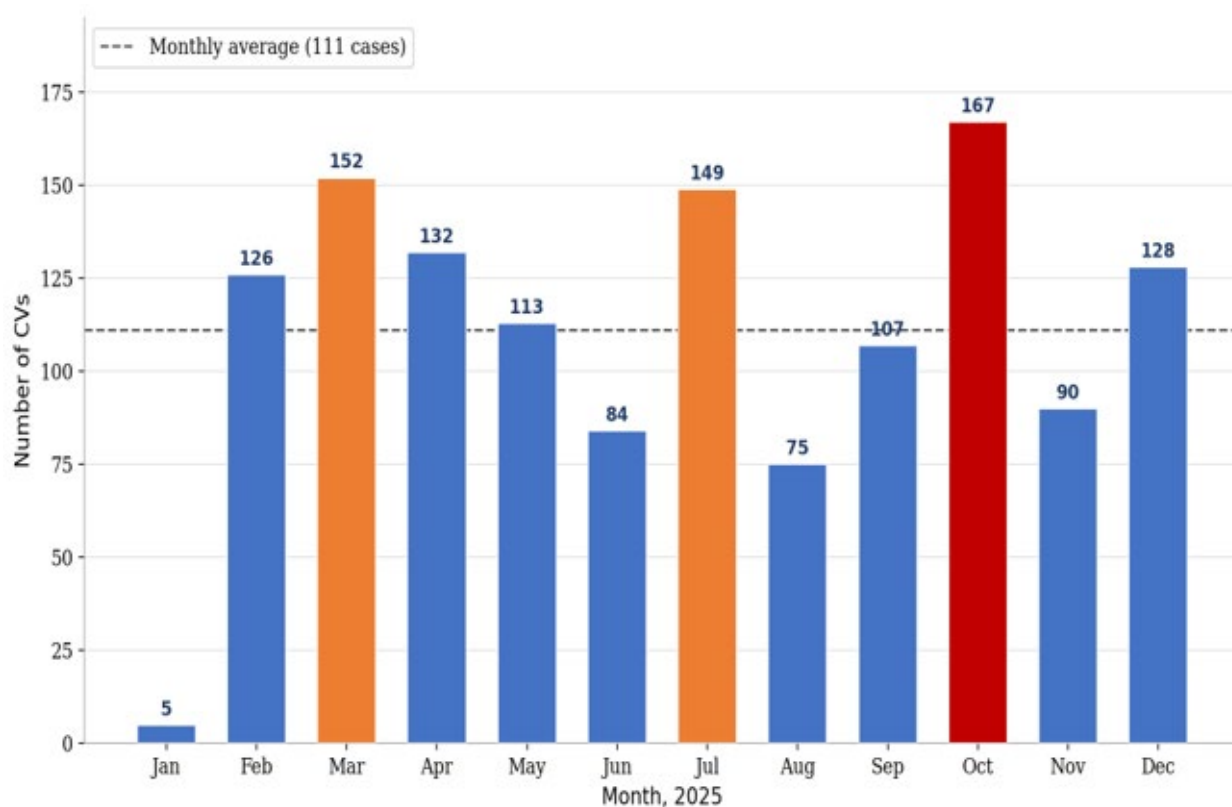


Figure 1. Monthly dynamics of critical values of hemostasis parameters in the oncology center CDL, 2025 ($n = 1,328$). Dashed line - mean monthly count (111 CVs). Red bar - peak month (October; $n = 167$). Orange bars - months exceeding 140 CVs (March, July).

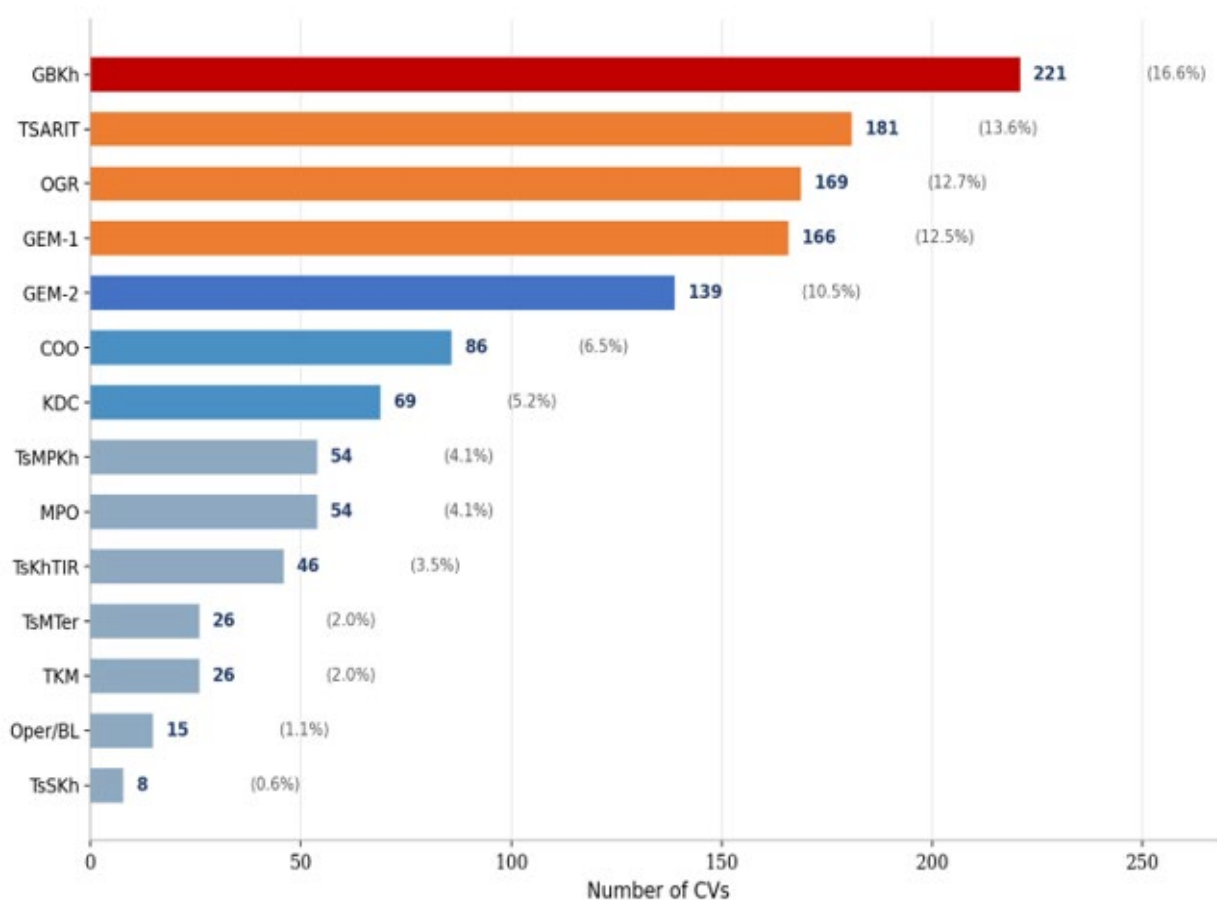


Figure 2. Distribution of critical values of hemostasis parameters by clinical ward, 2025 ($n = 1,328$). Bars sorted in descending order. Red bar - highest-burden ward (GBKh, $n = 221$). Percentage labels indicate each ward's share of the total annual CV count.

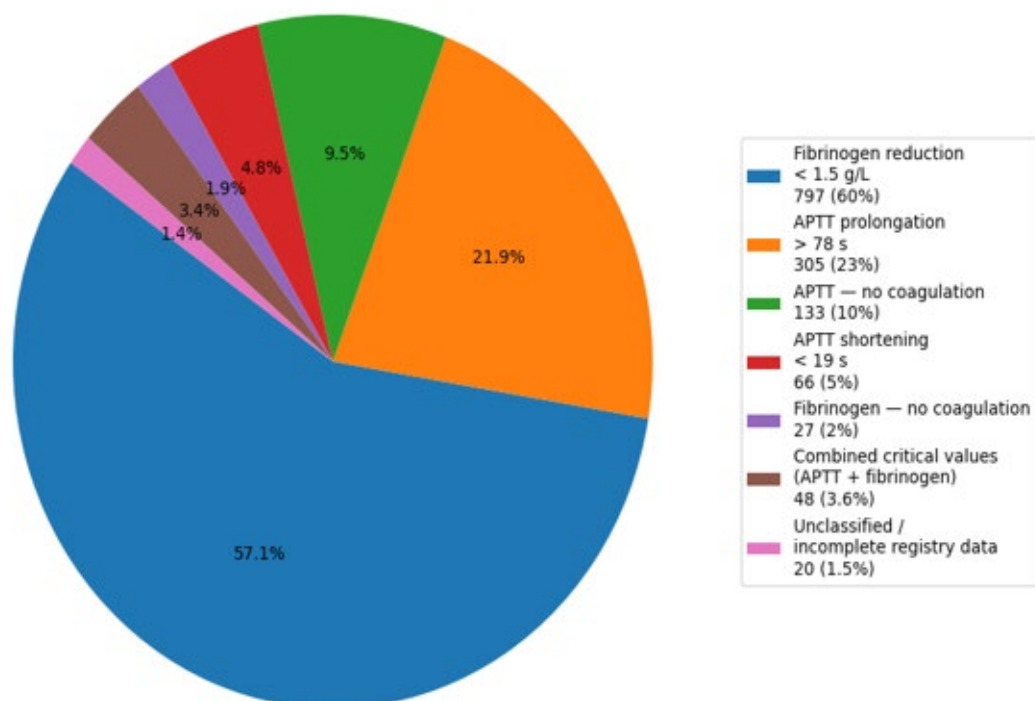


Figure 3. Structure of critical values of hemostasis parameters by type of disorder, 2025 ($n = 1,328$). The category “Combined critical values” represents simultaneous critical abnormalities of both APTT and fibrinogen within the same clinical episode.

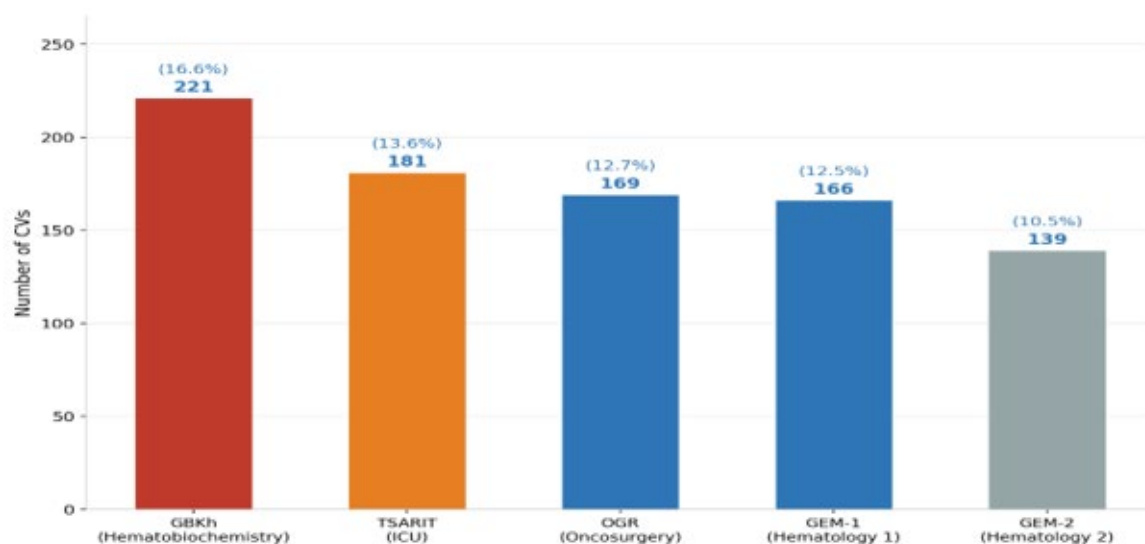


Figure 4. Top-5 clinical wards by CV burden, 2025 ($n = 876$ combined). Values above bars show absolute count and percentage of the annual total. GBKh and TSARIT together account for 30.2% of all registered CVs.



Figure 5. Annual trend of critical values by month, 2025 (line chart with area fill). Dashed orange line - mean monthly count (111 CVs). Annotations mark peak values (October, March, July) and the January minimum. The trend illustrates three distinct activity waves across the calendar year.

3. Structure of critical values by type of hemostatic disorder.

The structure of CVs by disorder category is presented in Table 4 and Figure 3.

Seven disorder categories are shown: (1) fibrinogen reduction < 1.5 g/L - severe hypofibrinogenemia; (2) APTT prolongation > 78 s - marked hypocoagulation; (3) absent coagulation by APTT - no clot formation detectable; (4) APTT shortening < 19 s - hypercoagulable state; (5) absent coagulation by fibrinogen - fibrinogen undetectable; (6) combined critical values - simultaneous critical abnormalities of both APTT and fibrinogen within the same clinical episode; (7) unclassified / incomplete registry data.

Fibrinogen reduction below 1.5 g/L was the most frequently registered disorder (797 cases; 60.0%), followed by APTT prolongation above 78 s (305; 23.0%). Cases of absent coagulation by APTT (133; 10.0%) and absent coagulation by fibrinogen (27; 2.0%) were of particular clinical significance, indicating extreme hypocoagulation with an immediate risk of life-threatening hemorrhage [3,8]. APTT shortening below 19 s (66; 5.0%) reflected hypercoagulable states, which, although less prevalent, carry an equally serious risk of thromboembolic complications in this patient population.

Combined critical abnormalities of APTT and fibrinogen represented a distinct subgroup of clinically significant events potentially reflecting severe consumption coagulopathy or disseminated intravascular coagulation.

The predominance of hypocoagulatory abnormalities suggests that hemorrhagic risk represents the principal hemostatic challenge in this oncology population. This finding is clinically important because severe hypofibrinogenemia and markedly prolonged APTT are frequently associated with disseminated intravascular coagulation, sepsis-associated coagulopathy,

liver dysfunction, and intensive antitumor therapy. In contrast, hypercoagulatory states accounted for a substantially smaller proportion of CVs, although they remain clinically relevant owing to the elevated thromboembolic risk characteristic of malignancy.

Discussion.

This study provides a comprehensive registry-based analysis of critical values (CVs) of hemostasis parameters, namely APTT and fibrinogen, in a specialized oncology center over a one-year period. The identification of 1,328 CV episodes highlights the substantial burden of coagulation disorders in this patient population and underscores the importance of continuous laboratory monitoring in oncology practice [1,2].

The observed incidence of 27.5 critical events per 1,000 coagulation tests confirms the exceptionally high burden of severe hemostatic disturbances in oncology practice compared with general hospital populations described in previous laboratory medicine studies.

The predominance of hypocoagulatory disorders observed in this study, with decreased fibrinogen levels and prolonged APTT accounting for 83% of all CVs, is consistent with the known pathophysiology of cancer-associated coagulopathy [1,2]. Malignant processes are characterized by simultaneous activation and consumption of coagulation factors, leading to an unstable hemostatic balance. Under additional stressors such as infection, surgery, or intensive chemotherapy, this imbalance may rapidly progress to disseminated intravascular coagulation (DIC) or severe consumption coagulopathy [2,9].

The identification of combined critical abnormalities of both APTT and fibrinogen further emphasizes the complexity and severity of coagulation disturbances in oncology patients, particularly in the setting of advanced systemic inflammation, sepsis, or disseminated intravascular coagulation.

Particularly noteworthy is the proportion of extreme hypocoagulatory states, including absence of clot formation in APTT (10%) and fibrinogen assays (2%). These findings indicate critical depletion of coagulation factors and are clinically associated with a high risk of life-threatening hemorrhage [8,9]. In such cases, timely communication of critical laboratory results becomes a key component of patient management and may directly influence clinical outcomes [4,6].

The statistically significant differences in CV distribution across clinical wards ($\chi^2(13) = 726.51$, $p < 0.001$) demonstrate that critical hemostatic abnormalities are not uniformly distributed but are concentrated in departments managing the most severely ill patients. The high proportion of CVs in the intensive care unit is consistent with the known prevalence of coagulation disorders in critically ill patients, where factors such as sepsis, organ failure, and massive transfusion contribute to hemostatic instability [2,10].

A similarly high burden observed in hematology wards reflects the combined effects of underlying hematological malignancies and intensive treatment regimens. These patients are particularly vulnerable to coagulation disturbances due to impaired hematopoiesis and reduced synthesis of coagulation factors [1,7], necessitating close laboratory surveillance.

Importantly, the current study demonstrates that critical hemostasis abnormalities are not isolated laboratory findings but represent an institutional patient-safety indicator reflecting the severity of the treated population and the intensity of oncological care.

The prominent contribution of the central hemostasis laboratory unit to the overall CV count can be explained by its central role in processing coagulation samples from multiple clinical units.

Therefore, GBKh-associated cases should not be interpreted as representing a single clinical patient population but rather as aggregated laboratory workflow data originating from multiple hospital departments. This organizational characteristic may partially limit direct comparison between GBKh and patient-admitting clinical wards

This organizational feature should be taken into account when interpreting ward-level distributions, as it may partially reflect aggregated data rather than direct clinical origin.

The observed seasonal variation in CV frequency ($\chi^2(10) = 72.80$, $p < 0.001$), with peaks in March, July, and October, suggests a relationship between laboratory workload and institutional clinical activity. These periods correspond to increased surgical interventions and intensified chemotherapy cycles, as well as a possible rise in infectious complications, which has also been reported in oncology and ICU populations [7].

The implementation of a structured electronic critical value registry combined with mandatory notification protocols constitutes an important component of modern laboratory governance. Such systems improve traceability of post-analytical processes, minimize communication failures, and support rapid clinical decision-making in time-critical situations [4,5,6,12].

Several limitations of this study should be considered. First, the retrospective single-center design limits the generalizability

of the findings to other oncology institutions. Second, the registry-based nature of the dataset did not permit detailed patient-level analysis of clinical outcomes such as bleeding events, thromboembolism, transfusion requirements, ICU mortality, or survival. Third, the use of requesting departments as analytical categories may have introduced partial classification bias because some units, particularly GBKh, function as centralized laboratory processing facilities rather than direct patient-admitting clinical wards. Finally, although the study demonstrates important epidemiological patterns of critical hemostasis abnormalities, causal relationships between laboratory findings and clinical outcomes cannot be established within the current design. Future multicenter prospective studies incorporating patient-level outcomes and clinician response metrics are warranted to further evaluate the clinical impact of critical value reporting systems in oncology practice.

Conclusion.

A total of 1,328 critical values of hemostasis parameters were registered in the clinical diagnostic laboratory of the oncology center in 2025, reflecting the high burden of coagulation disorders in this patient population. The most frequent abnormalities were hypofibrinogenemia and prolonged APTT, consistent with the pathophysiology of cancer-associated coagulopathy.

Statistically significant differences in the distribution of critical values across clinical departments ($\chi^2(13) = 726.51$, $p < 0.001$) and time periods ($\chi^2(10) = 72.80$, $p < 0.001$) indicate a non-random pattern associated with disease severity and institutional clinical activity.

Continuous real-time hemostasis monitoring, supported by an electronic critical value registry and standardized notification procedures, represents an essential component of patient safety in oncology settings. The findings of this study may contribute to optimization of laboratory workflows, improvement of critical value reporting systems, and more effective allocation of healthcare resources in specialized oncology centers. The present findings support the integration of laboratory critical value surveillance into institutional oncology quality-management programs and emphasize the importance of standardized communication algorithms for high-risk coagulation abnormalities.

Conflict of interest.

No conflicts of interest have been declared.

Authors' Contributions.

Conceptualization, N.Y. and A.M.; methodology, N.Y. and Z.K.; data curation, N.Y., Z.K., S.D., and A.S.; formal analysis, N.Y.; writing—original draft preparation, N.Y.; writing—review and editing, N.Y., N.I., and A.M.; supervision, A.M. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement.

This study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of the National Research Oncology Center, Astana, Republic of

Kazakhstan (Protocol No. 17, approved on 9 December 2025). Because the study was based exclusively on anonymized retrospective laboratory registry data, the requirement for individual informed consent was waived in accordance with institutional and national ethical regulations.

Informed Consent Statement.

Not applicable. This study used anonymized retrospective registry data; no direct patient contact or identifiable personal data were involved.

Data Availability Statement.

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

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