GEORGIAN MEDICAL NEWS

ISSN 1512-0112

NO 6 (375) Июнь 2026

ТБИЛИСИ - NEW YORK

ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии

საქართველოს სამედიცინო სიახლენი

GEORGIAN MEDICAL NEWS

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

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

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

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

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

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

WEBSITE

www.geomednews.com

К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

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

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

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

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

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

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

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

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

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

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

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

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

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

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

При нарушении указанных правил статьи не рассматриваются.

REQUIREMENTS

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

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

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

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

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

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

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

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

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

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

8. Please follow guidance offered to authors by The International Committee of Medical Journal Editors guidance in its Uniform Requirements for Manuscripts Submitted to Biomedical Journals publication available online at: http://www.nlm.nih.gov/bsd/uniform_requirements.html
http://www.icmje.org/urm_full.pdf
In GMN style for each work cited in the text, a bibliographic reference is given, and this is located at the end of the article under the title "References". All references cited in the text must be listed. The list of references should be arranged alphabetically and then numbered. References are numbered in the text [numbers in square brackets] and in the reference list and numbers are repeated throughout the text as needed. The bibliographic description is given in the language of publication (citations in Georgian script are followed by Cyrillic and Latin).

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

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

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

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

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

ავტორთა საყურადღებოდ!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დავიცვათ შემდეგი წესები:

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

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

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

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

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

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

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

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

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

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

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

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

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

GEORGIAN MEDICAL NEWS
NO 6 (375) 2026

Содержание:

GEORGIAN MEDICAL NEWS
No 6 (375) 2026

CLINICAL CHARACTERISTICS AND RISK FACTORS FOR ADVERSE OUTCOMES IN ELDERLY PATIENTS WITH SEVERE COVID-19

Hafiza S. Zhetpisbayeva[1], Karashash M. Askarova[1]*, Aigerim E. Tolendiyeva[1], Kalima T. Kupenova[2], Baglan O. Zharmagambetova[3], Nurzhamal D. Imambayeva[1]*, Zhaniya I. Zhakypova[4].

[1]NJSC "Astana Medical University", 49/A Beibitshilik Street, Astana 010000, Kazakhstan.

[2]JSC "National Scientific Medical Center", 42 Abylaikhan Avenue, Astana 010000, Kazakhstan.

[3]Multidisciplinary City Children's Hospital, 12 Ryskulov Street, Astana 020000, Kazakhstan.

[4]Nazarbayev University, 53 Kabanbay Batyr Avenue, Astana 010000, Kazakhstan.

Abstract.

Objective: To identify key clinical, laboratory, and imaging predictors of adverse outcomes in elderly patients aged 60-74 years with COVID-19.

Materials and Methods: A comprehensive retrospective analysis was conducted among elderly patients diagnosed with COVID-19. The participants were divided into two groups: survivors (n=50) and non-survivors (n=140). The study was conducted from May to October 2021 at the City Clinical Infectious Diseases Hospital No.3 in Astana, Kazakhstan. Statistical analysis was performed using non-parametric methods, including the Mann-Whitney U test.

Results: The mortality rate within the study cohort was 48%. Adverse outcomes were strongly associated with the development of a systemic inflammatory response. In the non-survivor group, critical median values were identified for C-reactive protein (CRP) - 97.9 mg/L, interleukin-6 (IL-6) - 38.15 pg/mL, and the lung involvement on CT imaging - 45.0% (IQR: 30.0-60.0%). Concomitant chronic bronchopulmonary pathology was also more frequent in the non-survivor group than in the survivor group (31% vs. 8%). Statistically significant differences between non-survivors and survivors were found for CRP levels (p=0.001), IL-6 levels (p=0.024), CT -assessed lung involvement (p=0.032), and chronic bronchopulmonary pathology (p=0.001).

Conclusion: This study identified critical markers of clinical decompensation in COVID-19 patients aged 60-74 years: lung involvement≥ 45% on CT imaging (CT-2/CT-3), IL-6 >40 pg/mL, and CRP >100 mg/L. Concomitant bronchopulmonary pathology was associated with an increase in mortality from 8% to 31%. These findings support the need for early targeted therapy when the specified threshold values are reached.

Key words. COVID-19, retrospective study, elderly patients, mortality, prognosis.

Introduction.

At the end of the second decade of the twenty-first century, the world faced an outbreak caused by a novel coronavirus, SARS-CoV-2. This virus, which belongs to the subgenus *Sarbecovirus* and the genus *Betacoronavirus*, is the causative agent of coronavirus disease 2019 (COVID-19) [1,2]. The COVID-19 outbreak rapidly escalated into a global public health emergency [3], posing a particularly serious threat to older adults [4,5].

The increased susceptibility of older adults to respiratory infections is driven by age-related involutive changes, including impaired mucociliary clearance [6,7], reduced lung elasticity [8], and structural changes in the upper airways [9]. As pulmonary defense mechanisms weaken with age, the body becomes increasingly vulnerable to viral and bacterial pathogens [10]. The profound vulnerability of elderly patients to COVID-19 is further compounded by age-related immune dysfunction and a high burden of comorbidities [11]. These factors may contribute to an excessive inflammatory response, including cytokine storm, which can lead to acute respiratory distress syndrome (ARDS), multi-organ failure, and increased risk of mortality. In addition, autopsy findings from patients with COVID-19 have revealed a high incidence of thromboembolic events, underscoring the important pathophysiological role of coagulopathy [12].

According to published data and meta-analyses, mortality rates within long-term care facilities (LTCFs) and nursing homes vary substantially, ranging from 29 to 47.5% in some studies to considerably lower rates in others [13-16].

A study by Liu K. et al. [17] confirmed a distinct age-dependent increase in COVID-19 mortality, with the rate rising sharply from less than 0.5% among individuals younger than 50 years to approximately 15% in those aged 80 years and older. One of the major clinical challenges in the elderly population is marked variability of disease presentation, ranging from classic triad of fever, cough, and dyspnea to the rapid development of life-threatening ARDS [18], which is associated with a high probability of in-hospital mortality [19]. Moreover, an atypical, "masked" or "silent", course of COVID-19 in frail and elderly patients substantially complicates timely diagnosis, conceals the true severity of hypoxemia, and elevates the risk of a fatal outcome [5]. Acute cognitive impairment, particularly delirium, may be the primary or even the only initial manifestation of COVID-19 in this population and may occur in the absence of typical laboratory abnormalities [20].

According to a large prospective cohort study, patients older than 85 years represent an exceptionally high-risk group. Their three-week mortality rate reached 28.9% and was closely associated with multimorbidity, with 64.5% of these patients having three or more chronic conditions [21]. Conversely, a meta-analysis including data from 43,128 patients [22] demonstrated a significant improvement in intensive care unit (ICU) outcomes during the first year of the pandemic, with mortality decreasing from 41.6% to 35.5%. The positive trend was attributed to a deeper understanding of the disease pathogenesis, standardized use of corticosteroids and anticoagulants, and personalized respiratory support.

Although predictors of COVID-19 mortality in elderly patients have been extensively studied, the observed statistical

variability highlights the need for a more detailed analysis that specifically accounts for age and sex distribution within the study population.

Research objectives.

To identify clinical markers and predictors of mortality in elderly patients with severe COVID-19.

Materials and Methods.

A retrospective analysis was conducted on 140 fatal cases among elderly patients with PCR-confirmed COVID-19, along with a comparison group of elderly patients who survived. The study was carried out at the City Clinical Infectious Diseases Hospital No.3 in Astana, Kazakhstan, from May to October 2021.

All data were extracted from electronic medical records and thoroughly reviewed. During the study period, the overall in-hospital mortality rate was 7.5% (292 out of 3,889 hospitalized patients). Elderly patients accounted for 48% of all deaths (140 out of 292 deceased patients). A comprehensive analysis was performed to evaluate clinical, laboratory, and imaging parameters, the length of hospital and intensive care unit (ICU) stay, and the therapies administered in both non-survivors and survivors.

All patients had confirmed SARS-CoV-2 infection based on positive real-time reverse transcription-polymerase chain reaction (RT-PCR) test from nasopharyngeal swabs. Chest computed tomography (CT) was performed to diagnose pneumonia. Vaccination status was excluded from the final analysis due to the low number of vaccinated individuals, with only seven vaccinated patients in total.

Inclusion criteria:

a) Age between 60 and 74 years;
b) Presence of pneumonia confirmed by chest computed tomography (CT);
c) Availability of complete laboratory data and a detailed medical history;
d) Confirmed positive RT-PCR result for SARS-CoV-2 from a nasopharyngeal swab;
e) Confirmed clinical outcome of the disease (either death or survival)

Exclusion criteria:

Patients belonging to other age groups hospitalized during the period from May to October 2021 were excluded from the study.

Statistical analysis:

Statistical analysis was performed using SPSS software, version 26.0. Continuous variables were presented as medians and interquartile ranges, Me (Q1–Q3), while categorical variables were presented as frequencies and percentages, n (%).

The statistical significance of differences between groups for quantitative variables was evaluated using the non-parametric Mann-Whitney U test. For categorical data, Pearson's chi-squared (χ^2) test was used when the expected frequencies were greater than 5, whereas Fisher's exact test was applied when the expected frequencies were less than 5. Odds ratios (ORs) were also calculated to estimate the strength of associations. For all statistical tests, differences were considered statistically significant at $p<0.05$.

Results.

The median age of elderly non-survivors was 69.0 years (IQR: 65.0-72.0), compared with 66.0 years (IQR: 63.75-72.25) in the survivor group. Females accounted for 54% (n=75) of the non-survivor group and 48% (n=24) of the survivor group, no statistically significant sex-related differences were observed between the groups (p=1.000).

Elderly non-survivors died after a median of 7.0 days (IQR: 2.0-10.0) from admission to the Department of Anesthesiology, Resuscitation, and Intensive Care. Notably, none of the surviving patients in this age group required transfer to the intensive care unit (ICU) (p< 0.001). The median length of hospital stay was 11.0 bed days (IQR: 7.0-17.0) in elderly non-survivors and 9.0 bed-days (IQR: 8.0-11.0) in survivors (p=0.261).

Table 1 presents a comparative analysis of comorbidities in the two groups: non-survivors and survivors. The most common comorbidities in both groups were arterial hypertension and type 2 diabetes mellitus. Arterial hypertension was observed in 64% of survivors (n=30) and 64% of non-survivors (n=90) (p=1.000), while type 2 diabetes mellitus was recorded in 26% of survivors (n=13) and 26% of non-survivors (n=36) (p=0.967). The key statistically significant difference was identified in the prevalence of bronchopulmonary pathology. Bronchitis, chronic obstructive pulmonary disease (COPD), and bronchiectasis were significantly more frequent in the non-survivor group than in the survivor group: 31% (n=44) versus 8% (n=4), respectively (p=0.001; Table 1). Other comorbidities, including coronary artery disease, chronic heart failure, kidney disease, and malignancies, were less frequent and did not differ significantly between the groups (Table 1). Cardiac arrhythmias, cerebrovascular diseases, anemia, liver diseases, and pulmonary hypertension were relatively rare and showed no statistically significant differences between the groups (p>0.05; Table 1).

Assessment of oxygenation parameters revealed marked hypoxemia under ambient air conditions among patients in the non-survivor group. The median oxygen saturation (SpO_2) without oxygen support reached critically low values of 84.5% (IQR: 75.0-88.5%), whereas in the survivor group this parameter remained within subnormal limits at 93.0% (IQR: 88.0-96.0%; p<0.001). After initiation of oxygen therapy, SpO2 values became comparable between the groups, reaching 94.5% (IQR: 91.75-96.5%) in survivors and 93.0% (IQR: 88.0-97.0%) in non-survivors, with no statistically significant difference (p=0.342).

Systolic and diastolic blood pressure values in both groups remained within the normal range regardless of clinical outcome, with no statistically significant differences observed between the groups (p=0.125 and p=0.056, respectively; Table 1). The compared groups were comparable and statistically homogeneous in terms of baseline systemic hemodynamic parameters, which excludes baseline arterial hypertension or hypotension as potential confounding factors influencing the final study outcomes.

Respiratory rate (RR) showed statistically significant differences depending on disease outcome (p=0.034). In patients with an adverse outcome, the median RR was 24.0 breaths/min (IQR: 22.0-26.0), whereas in the survivors it was 22.0 breaths/min (IQR: 21.0-24.0).

Analysis of heart rate (HR) demonstrated a trend toward higher values in non-survivors compared with survivors. The median HR was 85.0 bpm (IQR: 78.0-90.0) in the survivor group and 90.0 bpm (IQR: 79.5-98.5) in the non-survivor group (p=0.053).

A comparative analysis of the clinical presentation revealed both similarities in the frequency of several symptoms and statistically significant differences in key clinical manifestations (Table 1). Dyspnea was common in both survivor and non-survivor groups and did not differ significantly between them: 64% versus 67%, respectively (p=0.819). Similarly, the prevalence of the dry cough (64% vs. 59%; p=0.315), chest pain (20% vs. 26%; p=0.537), and pharyngalgia (14% vs. 20%; p=0.467) was comparable between the groups. Complaints of general weakness and lethargy were recorded in the majority of patients; however, this symptom was significantly more frequent among elderly survivors, occurring in 98% of cases compared with 84% in the non-survivor group (p=0.021).

The most pronounced differences were observed regarding the febrile response. Elevated body temperature was significantly more frequent in patients with a favorable outcome, occurring in 80% of survivors compared with 18% of non-survivors (p<0.001; Table 1). In contrast, myalgia and/or arthralgia were significantly more often associated with an adverse outcome: these complaints were reported by 24% of non-survivors and only 4% of survivors (p=0.004; Table 1). Productive cough was more frequent among survivors than among non-survivors (26% vs.14%), although this difference did not reach statistical significance (p=0.097). Other clinical manifestations, including dyspepsia (20% in both groups), dizziness (8% vs.6%), and altered consciousness (0% vs. 3%), did not differ significantly between the groups (p > 0.05).

Analysis of the complication profile in the study groups revealed statistically significant differences for most evaluated parameters (Table 3). Signs of respiratory failure of varying severity were recorded in all patients included in the study (100% in both groups). At the same time, the incidence of acute respiratory distress syndrome (ARDS) was significantly higher in the non-survivor group: 95% (133/140) compared with 20% (10/50) in the survivor group (p < 0.001).

A high incidence of systemic and organ dysfunction was observed among non-survivors. Multiple organ dysfunction syndrome (MODS) was recorded in 54% of patients (76/140), acute heart failure (AHF) in 87% (122/140), pulmonary embolism (PE) in 30% (42/140), and acute kidney injury (AKI) in 28% (39/140) (p < 0.001). These critical conditions were not recorded in the survivor group. Infectious-toxic complications in the form of sepsis were significantly more common among patients with fatal outcome, occurring in 36% of non-survivors (50/140) compared with 2% of survivors (1/50) (p < 0.001). Septic shock was not recorded in any case in the survivor group (0%), whereas it developed in 18% of non-survivors (n=25) (p= 0.003). The incidence of disseminated intravascular coagulation (DIC) syndrome and pulmonary hemorrhage did not differ significantly between the groups (p= 0.575). These complications were recorded exclusively among non-survivors, each occurring in 3% of cases (4/140).

Laboratory findings.

The laboratory data demonstrated a statistically significant difference in baseline white blood cell (WBC) counts between the two groups, although the median values in both groups remained within the normal reference range. The median WBC count was 7.95 x 109 /L (IQR: 5.14-13.5) in the non-survivors and 6.11 x 109 /L (IQR: 4.70-7.60) in survivors (p= 0.007; Table 2). Notably, the non-survivor group showed a wider dispersion of WBC values.

In patients with a fatal outcome, the median absolute neutrophil count (ANC) was 6.34 x 109 /L (IQR: 3.93-11.19), which was substantially higher than that observed in surviving elderly patients: 3.99 x 109 /L (IQR: 2.50- 6.31) (p< 0.001; Table 2).

No statistically significant intergroup differences were found in lymphocyte counts. Values in non-survivors were 0.83 x 109 /L (IQR: 0.60-1.11), which was comparable to those in survivors: 0.98 x 109 /L (IQR: 0.61-1.42) (p= 0.411). This suggests that lymphocyte count alone had no isolated prognostic value in this cohort. Monocyte counts in both groups remained within the normal range.

Analysis of platelet counts revealed a statistically significant difference between the groups. Survivors had a higher median platelet count of 209.0 x 109 /L (IQR: 168.0-324.0), whereas non-survivors had a lower median value of 175.0 x 109 /L (IQR: 146.0-244.0) (p=0.031; Table 2). Thus, a higher platelet count was associated with a more favorable survival prognosis.

A comparative analysis of biochemical markers of renal function revealed statistically significant differences in serum creatinine and blood urea levels between non-survivors and survivors. Both parameters were significantly higher in patients with fatal outcomes than in survivors (p=0.004 and p < 0.001, respectively; Table 2).

C-reactive protein (CRP) concentrations exceeded the upper limit of normal (ULN) by 19.6-fold and 10.3-fold in the non-survivor and survivor groups, respectively. In addition, CRP level in patients with fatal outcomes was almost twice as high as those in survivors (p= 0.001; Table 2).

Serum ferritin levels were elevated above the reference range in both groups (Table 2). Although the median ferritin level in non-survivors was almost twice as high as that in survivors (846.95 vs. 475.3), the difference did not reach statistical significance due to wide interquartile ranges (p= 0.205). Nevertheless, the observed increase in ferritin among non-survivors, together with multiple-fold elevations in CRP and interleukin-6 (IL-6), indicates the presence of a hyperinflammatory syndrome, or cytokine storm.

Hemostatic abnormalities were characterized by a statistically significant prolongation of activated partial thromboplastin time (aPTT) to 40.0 seconds (IQR: 30.3-104.8) in non-survivors, compared with 32.15 seconds (IQR: 27.97- 35.32) in survivors (p= 0.001). The median D-dimer level in non-survivors was elevated to approximately twice the upper limit of normal, reaching 1.0 mg/L (IQR: 0.13-3.13), whereas in survivors it remained within normal range at 0.43 mg/L (IQR: 0.19-1.58). However, this difference did not reach statistical significance (p=0.260).

Evaluation of serum transaminases showed no statistically significant differences in alanine aminotransferase (ALT) levels, with median values remaining within normal range in both groups. In contrast, patients with an adverse outcome had an approximately two-fold higher median aspartate

aminotransferase (AST) level compared to survivors: 50.1 U/L (IQR: 29.73-62.05) versus 27.48 U/L (IQR: 18.64-44.47) (p= 0.001; Table 2).

In the survivor group, the median procalcitonin (PCT) level was 0.08 ng/mL (IQR: 0.05-0.11), whereas in the non-survivor group it was more than two times higher, at 0.18 ng/mL (IQR: 0.05-0.65). However, the difference was not statistically significant (p=0.177).

Thus, the laboratory findings demonstrate that the majority of elderly non-survivors with COVID-19 exhibited evidence of a systemic inflammatory response, reflected by elevated IL-6, CRP, and ferritin levels, as well as clinically relevant coagulation abnormalities, including elevated D-dimer and prolonged aPTT. An upward trend in procalcitonin levels was also observed, although it did not reach statistical significance (Table 2).

Analysis of chest CT findings (Table 3) showed that bilateral polysegmental infiltration and the ground-glass opacity (GGO) pattern with consolidation predominated in all patients, regardless of the clinical outcome, occurring in 96-100% of cases. The extent of lung involvement was significantly higher in non-survivors, with a median value of 45%, compared to 30% in survivors (p=0.032).

Table 1. *Clinical characteristics of elderly patients with COVID-19 according to disease outcome.*

Parameter	**Survivors, n=50, Me (Q1–Q3)**	**Non-survivors, n=140, Me (Q1–Q3)**	**p –value**
Age, years	66.0 (63.75–72.25)	69.0 (65.0–72.0)	0.517
Female sex, n (%)	24 (48%)	75 (54%)	1.000
Length of hospital stay, days	9.0 (8.0–11.0)	11.0 (7.0–17.0)	0.261
ICU stay, days	0.0 (0.0–0.0)	7.0 (2.0–10.0)	<0.001*
Systolic Blood Pressure, mmHg	128.0 (112.0–140.0)	120.0 (112.5–130.0)	0.125
Diastolic Blood Pressure, mmHg	82.0 (78.0–90.0)	80.0 (70.0–80.0)	0.056
Heart Rate (HR), bpm	85.0 (78.0–90.0)	90.0 (79.5–98.5)	0.053
Respiratory rate (RR), breaths/min	22.0 (21.0–24.0)	24.0 (22.0–26.0)	0.034*
Baseline SpO_2 (ambient air), %	93.0 (88.0–96.0)	84.5 (75.0–88.5)	<0.001*
SpO_2 during oxygen therapy, %	94.5 (91.75–96.5)	93.0 (88.0–97.0)	0.342
Comorbidities, n (%)			
Arterial Hypertension	32 (64%)	90 (64%)	1.000
Coronary Artery Disease	9 (18%)	40 (29%)	0.131
Cardiac Arrhythmia	2 (4%)	4 (3%)	0.659
Chronic Heart Failure	5 (10%)	23 (16%)	0.274
Cerebrovascular Disease	5 (10%)	17 (12%)	0.681
Type 2 Diabetes Mellitus	13 (26%)	36 (26%)	0.967
Obesity	13 (26%)	55 (39%)	0.089
Concomitant bronchopulmonary pathology (COPD, bronchitis, bronchiectasis)	4 (8%)	44 (31%)	0.001*
Pulmonary Hypertension	1 (2%)	0	0.263
Anemia	1 (2%)	4 (3%)	1.000
Kidney Disease	2 (4%)	15 (11%)	0.166
Liver Disease	2 (4%)	9 (6.4%)	0.724
Malignancies	1 (2%)	12 (9%)	0.113
Symptoms, n (%)			
Fever	40 (80%)	25 (18%)	<0.001*
General weakness and lethargy	49 (98%)	118 (84%)	0.021*
Myalgia and/or arthralgia	2 (4%)	33 (24%)	0.004*
Headache	14 (28%)	36 (26%)	0.898
Dizziness	4 (8%)	8 (6%)	0.518
Altered consciousness	0 (0%)	4 (3%)	0.575
Dyspnea	32 (64%)	94 (67%)	0.819
Dry cough	34 (64%)	82 (59%)	0.315
Productive cough	13 (26%)	20 (14%)	0.097
Hemoptysis	2 (4%)	1 (0.7%)	0.170
Chest pain	10 (20%)	36 (26%)	0.537
Pharyngalgia/ sore throat	7 (14%)	28 (20%)	0.467
Dyspepsia	10 (20%)	28 (20%)	1.000
Anosmia and/or ageusia	11 (22%)	11 (8%)	0.015*

Note: *Data are presented as Me (Q_1–Q_3) for quantitative variables and as n (%) for categorical variables. Me denotes the median; Q_1 and Q_3 denote the 25th and 75th percentiles, respectively. The statistical significance of differences between groups for quantitative variables was calculated using the Mann-Whitney U test. For categorical variables, Pearson's χ^2 test was used when expected frequencies were ≥5, whereas Fisher's exact test was applied when expected frequencies were <5. *- differences are statistically significant at p < 0.05.*

Table 2. *Laboratory findings in elderly patients with COVID-19 according to disease outcome.*

Parameter	Reference range	Survivors, n=50, Me (Q1–Q3)	Non-survivors, n=140, Me (Q1–Q3)	p–value
White Blood Cells (WBC), x10⁹	4 – 9	6.11 (4.7–7.6)	7.95 (5.14–13.5)	0.007*
Absolute Neutrophil Count (ANC), x10⁹	2.5 – 6.0	3.99 (2.50–6.31)	6.34 (3.93–11.19)	<0.001*
Absolute Lymphocyte Count (ALC), x10⁹	1.0 – 3.5	0.98 (0.61–1.42)	0.83 (0.60–1.11)	0.411
Absolute Monocyte Count (AMC), x10⁹	0.4 – 0.8	0.45 (0.25–0.86)	0.46 (0.25–0.65)	0.896
Hemoglobin (Hb), g/L	120 – 140	133.0 (122.0–146.0)	130.0 (121.0–141.5)	0.320
Platelet (PLT) count, x10⁹	180 – 350	209.0 (168.0–324.0)	175.0 (146.0–244.7)	0.031*
Prothrombin Time (PT), sec	9 – 15	15.2 (13.4–17.1)	15.8 (14.0–18.0)	0.262
Activated Partial Thromboplastin Time (aPTT), sec	25 – 37	32.15 (27.97–35.32)	40.0 (30.3–104.8)	0.001*
D-dimer, mg/L	0 – 0.5	0.43 (0.19–1.58)	1.0 (0.13–3.13)	0.260
Alanine Aminotransferase (ALT), U/L	17 – 40	31.46 (12.72–41.98)	29.85 (19.68–45.53)	0.297
Aspartate Aminotransferase (AST), U/L	17 – 40	27.48 (18.64–44.47)	50.1 (29.73–62.05)	0.001*
Blood Urea Nitrogen (BUN), mmol/L	3.2 – 7.3	4.32 (3.19–6.06)	7.48 (5.08–12.82)	<0.001*
Serum Creatinine, µmol/L	44 – 104	58.06 (50.98–67.35)	73.44 (54.65–103.9)	0.004*
C-Reactive Protein (CRP), mg/L	0 – 5	51.6 (16.12–93.15)	97.9 (53.55–180.9)	0.001*
Procalcitonin (PCT), ng/mL	0 – 0.046	0.08 (0.05–0.11)	0.18 (0.05–0.65)	0.177
Serum Ferritin, µg/L	30 – 400	475.3 (298.65–904.5)	846.95 (250.0–1439.8)	0.205
Interleukin-6 (IL-6), pg/mL	0 – 7	5.22 (1.85–46.41)	38.15 (8.6–114.65)	0.024*

Note: *Data are presented as Me (Q1–Q3), where Me is the median, Q1 and Q3 are the 25th and 75th percentiles, respectively. The statistical significance of differences between groups was calculated using the Mann-Whitney U test. *- differences are statistically significant at p< 0.05.*

Table 3. *Imaging findings and clinical complications in elderly patients according to disease outcome.*

Parameters	Survivors (n=50), n (%)	Non-survivors (n=140), n (%)	p–value
Imaging Findings, n (%)			
Volume of lung parenchyma involvement on CT,%	30.0 (24.75–50.0)	45.0 (30.0–60.0)	0.032*
Bilateral polysegmental localization	50 (100%)	134 (96%)	0.343
Ground-glass opacity (GGO)	50 (100%)	140 (100%)	1.000
Pulmonary fibrosis	5 (10%)	12 (9%)	0.776
Bullae	1 (2%)	6 (4%)	0.678
Bronchiectasis	1 (2%)	8 (6%)	0.449
Bronchial wall thickening	34 (67%)	80 (57%)	0.239
Lesion	0 (0%)	3 (2%)	0.568
Pneumothorax	0 (0%)	7 (5%)	0.193
Pneumomediastinum	1 (2%)	34 (24%)	0.001*
Hydrothorax/ Pleural effusion	4 (8%)	7 (5%)	0.484
Intrathoracic lymphadenopathy	10 (20%)	6 (4.3%)	0.002*
Signs of pulmonary hypertension	2 (4%)	12 (9%)	0.362
Cystic hypoplasia	0 (0%)	6 (4%)	0.343
Complications, n (%)			
Respiratory failure	50 (100%)	140 (100%)	1.000
Acute Respiratory Distress Syndrome (ARDS)	10 (20%)	133 (95%)	<0.001*
Pulmonary embolism (PE)	0 (0%)	42 (30%)	<0.001*
Multiple Organ Dysfunction Syndrome (MODS)	0 (0%)	76 (54%)	<0.001*
Acute Heart Failure (AHF)	0 (0%)	122 (87%)	<0.001*
Sepsis	1 (2%)	50 (36%)	<0.001*
Septic shock	0 (0%)	25 (18%)	0.003*
Disseminated Intravascular Coagulation (DIC) syndrome	0 (0%)	4 (3%)	0.575
Pulmonary hemorrhage	0 (0%)	4 (3%)	0.575
Acute Kidney Injury (AKI)	0 (0%)	39 (28%)	<0.001*

Note: *Data are presented as Me (Q_1–Q_3) for quantitative variables and as n (%) for categorical variables. Me denotes the median; Q_1 and Q_3 denote the 25th and 75th percentiles, respectively. The Mann–Whitney U test was used for quantitative variables. Pearson's chi-squared test was used for categorical variables when expected frequencies were greater than 5, and Fisher's exact test was used when expected frequencies were less than 5. *- differences are statistically significant at p < 0.05.*

Pneumomediastinum was observed in 24% of non-survivors and only 2% of survivors (p=0.001), indicating that it may serve as a highly reliable marker of severe disease progression and increased mortality risk. Conversely, intrathoracic lymphadenopathy was found in 20% of survivors and only 4.3% of non-survivors (p=0.002), which may reflect a more pronounced and active immune response in patients who recovered.

Other structural changes in the lungs, bronchial tree, extrapulmonary tissues, and vasculature showed no statistically significant differences between survivors and non-survivors (p> 0.05). This suggests that these findings occurred with similar frequency in both groups and did not directly affect the clinical outcome in the present study sample.

Treatment and medical management.

Analysis of the respiratory support structure revealed a direct relationship between the intensity of therapy and the severity of the patients' clinical condition. Standard mask oxygen therapy was effective in 85% of the survivors. The remaining 15% of patients in this group required escalation to non-invasive ventilation (NIV) in continuous positive airway pressure (CPAP) mode with a fraction of inspired oxygen (FiO2) of 70%.

In the non-survivor group, the severity of respiratory failure required escalation to invasive mechanical ventilation and advanced non-invasive respiratory support modalities.

Etiotropic treatment with remdesivir was administered to approximately half of the patients in both groups, ranging from 38% to 46%. In addition, nearly 100% of all patients received combination antibiotic therapy consisting of two or more antimicrobial agents. Anticoagulants, including unfractionated heparin and enoxaparin, were used in the vast majority of patients regardless of the clinical outcome: 96% of survivors and 88.5% of non-survivors. Antiplatelet therapy with acetylsalicylic acid was administered to 86% and 82.8% of patients, respectively.

In accordance with the national clinical management protocol, dexamethasone was administered to 94% of the surviving elderly patients and 97.1% of elderly non-survivors. Immunosuppressive therapy with tocilizumab was used infrequently in 4% in survivors and 14.2% of non-survivors, due to its high cost, strict eligibility criteria, and the risk of secondary bacterial infections. Additionally, standard treatment of pre-existing comorbidities was provided in both groups.

Discussion.

In the study, we conducted a comprehensive evaluation of clinical, laboratory, and imaging parameters in elderly patients with COVID-19 who either recovered or had a fatal outcome, with the aim of identifying key predictors of adverse outcomes. The mortality rate observed among elderly patients aged 60-74 years was 48%, which is comparable to the findings of large international cohort studies reporting mortality rates ranging from 29% to 47.5% [14,16]. At the same time, the mortality in our cohort was higher than that reported in several other publications [23]. These findings confirm that elderly patients represent a high-risk group for adverse outcomes in COVID-19, which is consistent with the results of other studies [17,24].

Our findings showed that elderly non-survivors initially had a more severe disease course compared with survivors. This was mainly associated with the development of a systemic inflammatory response and cytokine storm. Pronounced neutrophilia, hyperferritinemia, and marked increases in CRP and IL-6 levels were identified as laboratory predictors of adverse outcome. IL-6 is considered a key marker of cytokine storm and a major trigger of hepatic synthesis of acute-phase proteins, including CRP and ferritin. The observed correlation between IL-6 and D-dimer levels (r= 0.312) may explain how systemic inflammation contributes to coagulation disorders. In the non-survivor group, this was manifested by coagulopathy, including prolonged activated partial thromboplastin time (aPTT) and increased D-dimer levels. Cytolytic syndrome, reflected by elevated AST levels, together with renal dysfunction, indicated by significantly higher creatinine and urea levels in non-survivors, suggests widespread organ damage and progression toward multiple organ dysfunction syndrome (MODS). These findings are consistent with the retrospective cohort study by F. Zhou et al. [19], as well as with reports by other investigators [24-29].

Bilateral polysegmental interstitial infiltration with ground-glass opacities (GGO) and consolidation was the main radiological feature of severe COVID-19 in both study groups (Table 3). Chest CT findings showed that elderly non-survivors had a significantly greater median extent of lung parenchymal involvement than survivors of the same age: 45.0% (IQR: 30.0-60.0%) versus 30.0% (IQR: 24.75-50.0%), respectively. Notably, the upper limit of lung involvement in survivors, 50%, overlapped with the risk range observed in non-survivors. This finding suggests that, due to reduced tolerance to hypoxia in older adults, death may occur even at a median lung involvement of approximately 45%, corresponding to CT-2/CT-3 categories. Therefore, extensive lung involvement on CT combined with critical abnormalities in laboratory biomarkers, including markers of systemic inflammation and coagulopathy, should be considered an unfavorable prognostic pattern requiring treatment intensification. CT findings should not be interpreted in isolation but rather in combination with inflammatory markers, including CRP and D-dimer, oxygen saturation, and overall organ function. This approach is consistent with a large-scale meta-analysis by M. Francone et al. [30], which also reported a direct association between chest CT severity score, inflammatory biomarker levels, and mortality risk.

Although a substantial burden of comorbidities was observed in most elderly patients regardless of clinical outcome [19], the specific pattern of concomitant disease appeared to have different prognostic significance. The comparable prevalence of major socially significant conditions, such as arterial hypertension and type 2 diabetes mellitus, between the groups (p>0.05) suggests that these disorders act as baseline aggravating factors rather than direct determinants of in-hospital mortality. This is further supported by the calculated odds ratio (OR=1.00; 95% CI: 0.50-1.98; p>0.05), which indicated no direct association between these individual conditions and the fatal outcome in the present cohort. Instead, in older age groups, cumulative comorbidity burden may have greater prognostic value. In patients with COVID-19, the clustering of pre-existing chronic diseases, particularly underlying pulmonary pathology, appears to be more clinically relevant for adverse outcomes than any single background condition.

In the present study, chronic bronchopulmonary pathology, including chronic bronchitis, COPD and bronchiectasis, was identified as an important predictor of mortality. It was recorded almost four times more frequently in non-survivors than in survivors: 31% versus 8%, respectively. These findings are consistent with the results of a comprehensive meta-analysis [31], which demonstrated that concomitant respiratory pathology is associated with an increased risk of COVID-19-related hospitalization and death.

Clinical parameters, such as respiratory rate (RR) and blood oxygen saturation (SpO2), are important prognostic markers closely associated with the risk of in-hospital mortality [32]. The critically low median SpO2 value of 84.5% observed under ambient air conditions in the non-survivor group reflects the failure of compensatory mechanisms and the development of severe arterial hypoxemia. In contrast, respiratory function in the survivor group remained within subnormal limits, with a median SpO2 of 93.0%, suggesting preserved pulmonary functional reserve.

However, achieving target SpO2 levels through supplemental oxygen therapy did not prevent fatal outcomes in the non-survivor group. This may be explained by the development of tissue hypoxia in the setting of multiple organ dysfunction, when normalization of systemic hemoglobin saturation is no longer sufficient to restore adequate oxygen utilization at the cellular level [33].

The predominance of fever in the survivor group, 80% versus 18% in non-survivors ($p < 0.001$), may indicate preserved host reactivity and a more adequate immune response, which could contribute to a lower risk of mortality. This interpretation is supported by literature data [34] emphasizing the importance of a preserved immune response for effective viral elimination in older adults. In contrast, the higher frequency of myalgia and arthralgia among patients with a fatal outcome may reflect a systemic inflammatory response associated with increased production of pro-inflammatory cytokines, including IL-6 and TNF-alpha. Similar observations have been described in an international study linking arthromyalgias with age-related immunosenescence and increased mortality risk [35].

In contrast to previously published studies [20,21,36,37], which identifies atypical symptoms such as asthenia, falls, delirium and confusion as common manifestations of SARS-CoV-2 infection in elderly patients, confusion and falls were recorded infrequently in the present study, occurring in only 3% of cases among non-survivors.

Analysis of the complication profile showed that the incidence of acute respiratory distress syndrome (ARDS) was critically high in the non-survivor group compared with survivors: 95% versus 20%, respectively ($p<0.001$). ARDS may have served as a major trigger for a cascade of systemic pathological reactions, including acute heart failure (87%) and multiple organ dysfunction syndrome (MODS; 54%), whereas these critical conditions were not recorded in the survivor group. The development of sepsis, which was significantly more frequent in non-survivors than in survivors (36% vs. 2%; $p<0.001$), together with septic shock occurring exclusively in non-survivors (18%), may represent an important mechanism contributing to MODS through systemic inflammatory and generalized endothelial injury [38,39]. These findings are consistent with international data from the LUNG SAFE study [40]. Overall, the results support the need to optimize initial empirical antibiotic therapy and pathogenetically targeted management in this critically ill patient population.

The intensity of respiratory support was directly related to the severity of the patients' clinical condition. The effectiveness of standard mask oxygen therapy in 85% of survivors indicates that those compensatory mechanisms remained preserved in most patients with favorable outcomes. Escalation to non-invasive ventilation (NIV) in continuous positive airway pressure (CPAP) mode with FiO2 70% in the remaining 15% of survivors was required because of worsening hypoxemia. In the non-survivor group, initial oxygen therapy proved ineffective, requiring escalation to invasive mechanical ventilation (IMV) or advanced non-invasive respiratory support. These findings support the role of refractory hypoxemia as an important predictor of mortality.

Etiotropic and pathogenetic therapy.

Our data showed that remdesivir was administered with comparable frequency in the survivor and non-survivor groups: 38% and 46%, respectively ($p>0.05$). However, its use in patients with severe COVID-19 was not associated with a clear improvement in clinical outcomes. The limited effectiveness observed in the non-survivor group may be explained by the fact that, at the stage of severe lung injury, the pathogenesis of COVID-19 is driven predominantly by a systemic hyperinflammatory response rather than active viral replication. Therefore, isolated antiviral therapy at advanced stages of the disease may have limited clinical benefit. These findings suggest that use of remdesivir in severe COVID-19 does not necessarily guarantee clinical efficacy [13].

During the pandemic, empirical antibiotic therapy was used in nearly all hospitalized patients with severe COVID-19. However, this approach did not appear to improve clinical outcomes in patients with fatal disease progression. From a pathogenetic perspective, the unjustified use of antibacterial agents, particularly in the setting of polypharmacy, may increase the risk of systemic toxicity and contribute to the development of antimicrobial resistance, which is consistent with previously published data [41,42].

The routine administration of anticoagulants in the majority of patients was not sufficient to prevent fatal outcomes in those with severe disease, supporting the key role of thrombosis and immunothrombosis in the pathogenesis of severe COVID-19. These findings emphasize the importance of early initiation of anticoagulant and antiplatelet therapy in patients at high risk of thrombotic complications [43,44].

In the present study, dexamethasone showed limited effectiveness in preventing death among patients with severe COVID-19, although it remains a standard component of treatment for severe COVID-19 according to the RECOVERY trial [45]. In patients with severe COVID-19 and hyperinflammation, therapeutic strategies have also included selective cytokine blockage with tocilizumab [46]. However, tocilizumab has not consistently demonstrated effectiveness in preventing death, including in hospitalized patients with

moderate COVID-19 [47]. The limited effect of tocilizumab on mortality may be related to its narrow mechanisms of action, as it blocks only the interleukin-6 receptor pathway, whereas severe COVID-19 is characterized by a broader multi-cytokine inflammatory cascade and multi-organ injury.

Practical significance.

This study identified specific high- risk biomarkers associated with mortality in elderly patients with COVID-19, including CRP>100 mg/L and IL-6>40 pg/mL. Due to age-related reduction in tolerance to hypoxia, elderly patients may experience fatal outcomes even with median lung involvement of approximately 45%, corresponding to CT-2/CT-3 categories. The combination of these laboratory thresholds, CT-assessed lung involvement ≥ 45%, and pre-existing chronic bronchopulmonary pathology, such as COPD or chronic bronchitis, may serve as a clinically useful tool for reassessing disease severity and identifying elderly patients at increased risk of adverse outcomes.

Conclusion.

The present study demonstrates that, in COVID-19 patients aged 60-74 years, a critical depletion of adaptive physiological reserve may occur at a median lung involvement of 45%, corresponding to CT-2/ CT-3 categories. Exceeding the thresholds of IL-6 > 40 pg/mL and CRP

>100 mg/L may indicate systemic decompensation. In addition, concomitant bronchopulmonary pathology was associated with an almost fourfold increase in the risk of fatal outcome, with mortality observed in 31% of patients with such comorbidities compared with 8% of those without them. These findings support the need for early targeted therapy when the specified laboratory and tomographic criteria are reached, with the aim of reducing mortality in this vulnerable age group.

REFERENCES

1. Gorbalenya AE, Baker SC, Baric RS et al. The species severe acute respiratory syndrome-related coronavirus: classifying 2019-nCoV and naming it SARS-CoV-2. Nat Microbiol. 2020;5:536-544.
2. Zhou P, Yang X.L, Wang X.G, et al. A pneumonia outbreak associated with a new coronavirus of probable bat origin. Nature. 2020;579:270-273.
3. Sohrabi C, Alsafi Z, O'Neill N, et al. World Health Organization declares global emergency: A review of the 2019 novel coronavirus (COVID-19). International Journal of Surgery. 2020;76:71-76.
4. Mueller A.L, McNamara M.S, Sinclair D.A. Why does COVID-19 disproportionately affect older people?. Aging (Albany NY). 2020;12:9959-9981.
5. Tkacheva O.N, Kotovskaya Yu.V, Aleksanyan L.A, et al. New coronavirus infection SARS-CoV-2 in elderly and senile patients: features of prevention, diagnosis and treatment. Agreed position of experts of the Russian Association of Gerontologists and Geriatricians. Cardiovascular Therapy and Prevention. 2020;19:2601.
6. Bailey K.L, Bonasera S.J, Wilderdyke M, et al. Aging causes a slowing in ciliary beat frequency, mediated by PKCε. American Journal of Physiology-Lung Cellular and Molecular Physiology. 2014;306:L584-L589.
7. Svartengren M, Falk R, Philipson K. Long-term clearance from small airways decreases with age. Eur Respir J. 2005;26:609-615.
8. Brandsma C.A, de Vries M, Costa R, et al. Lung ageing and COPD: is there a role for CXCR2 signaling? American Journal of Physiology-Lung Cellular and Molecular Physiology. 2021;320:L1029-L1040.
9. Martin SE, Mathur R, Marshall I, et al. The effect of age, sex, obesity and posture on upper airway size. Eur Respir J. 1997;10:2087-2090.
10. Di YP, Kuhn JM, Mangoni ML. Lung antimicrobial proteins and peptides: from host defense to therapeutic strategies. Physiol Rev. 2024;104:1643-1677.
11. Wang L, He W, Yu X, et al. Coronavirus disease 2019 in elderly patients: characteristics and prognostic factors based on 4-week follow-up. J Infect. 2020.
12. Wichmann D, Sperhake J-P, Lütgehetmann M et al. Autopsy fndings and venous thromboembolism in patients with COVID-19: a prospective cohort study. Ann Intern Med. 2020.
13. Beigel J.H, Tomashek K.M, Dodd L.E, et al. Remdesivir for the treatment of Covid-19 — Final report. N Engl J Med. 2020;383:1813-1826.
14. Brouns S.H, Brüggemann R, Linkens AEMJH, et al. Mortality and the use of antithrombotic therapies among nursing home residents with COVID-19. J Am Geriatr Soc. 2020;68:1647-1652.
15. McMichael TM, Currie DW, Clark S, et al. Epidemiology of Covid-19 in a longterm care facility in King County, Washington. N Engl J Med. 2020;382:2005-2011.
16. Patel MC, Chaisson LH, Borgetti S, et al. Asymptomatic SARS, CoV-2 infection and COVID-19 mortality during an outbreak investigation in a skilled nursing facility. Clin Infect Dis. 2020.
17. Liu K, Chen Y, Lin R, et al. Clinical features of COVID-19 in elderly patients: A comparison with young and middle-aged patients. J Infect. 2020;80:e14-e18.
18. Chen N, Zhou M, Dong X, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. Lancet (Lond Engl). 2020;395:507-513.
19. Zhou F, Yu T, Du R, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. Lancet. 2020;395:1054-1062.
20. Olde Rikkert MGM, Vingerhoets RW, van Geldorp N, et al. Atypical clinical picture of COVID-19 in older patients. Tijdschr Geneeskd. 2020;164:D5004.
21. Vrillon A, Hourregue C, Azuar J, et al. COVID-19 in Older Adults: A Series of 76 Patients Aged 85 Years and Older with COVID-19. J Am Geriatr Soc. 2020;68:2735-2743.
22. Armstrong R.A, Kane A.D, Kursumovic E, et al. Mortality in patients admitted to intensive care with COVID-19: an updated systematic review and meta-analysis of observational studies. Anaesthesia. 2021;76:537-548.
23. Tan LF, Seetharaman SK. COVID-19 outbreak in nursing homes in Singapore. J Microbiol Immunol Infect. 2020.
24. Fabio Perrotta, Graziamaria Corbi1, Grazia Mazzeo, et al. COVID-19 and the elderly: insights into pathogenesis and clinical decision-making. Aging Clinical and Experimental Research. 2020;32:1599-1608.

25. Asakura H, Ogawa H. Coagulopathy and disseminated intravascular coagulation associated with COVID-19. Int J Hematol. 2021;113:45-57.
26. Mehta P, McAuley DF, Brown M, et al. COVID-19: consider cytokine storm syndromes and immunosuppression. Lancet. 2020;395:1033-1034.
27. Sizyakina L.P, Zakurskaya V.Ya, Skripkina N.A, et al. Ferritin level as a predictor of COVID-19 severe course. Immunologiya. 2021;42:518-525.
28. Thachil J, Ning Tang N, Satoshi Gando S, et al. ISTH interim guidance on recognition and management of coagulopathy in COVID-19. J Thromb Haemost. 2020;18:1023-1026.
29. Perrotta F, Corbi G, Mazzeo G, et al. COVID-19 and the elderly: insights into pathogenesis and clinical decision-making. Aging Clinical and Experimental Research. 2020;32:1599-1608.
30. Francone M, Iafrate F, Masci GM, et al. Chest CT score in COVID-19 patients: correlation with disease severity and short-term prognosis. Eur Radiol. 2020;30:6808-6817.
31. Gerayeli FV, Milne S, Cheung C, et al. COPD and the risk of poor outcomes in COVID-19: A systematic review and meta-analysis. EClinicalMedicine. 2021;33:100789.
32. Mejía F, Medina C, Cornejo E, et al. Oxygen saturation as a predictor of mortality in hospitalized adult patients with COVID-19 in a public hospital in Lima, Peru. PLoS One. 2020;15:e0244171.
33. Østergaard L, Granfeldt A, Secher N, et al. Microcirculatory dysfunction and tissue oxygenation in critical illness. Acta Anaesthesiol Scand. 2015;59:1246-59.
34. Pietrobon AJ, Teixeira FME, Sato MN. I mmunosenescence and Inflammaging: Risk Factors of Severe COVID-19 in Older People. Front. Immunol. 2020;11:579220.
35. Turner J. Atypical Presentation of COVID-19 in Frail Older Adults: The Masked Cytokine Storm and Its Prognostic Value. Frontiers in Medicine. 2020;7:595604.
36. Alkeridy W.A, Almaglouth I, Alrashed R, et al. A unique presentation of delirium in a patient with otherwise asymptomatic COVID-19. J Am Geriatr Soc. 2020;68:1382-1384.
37. Neerland BE, Dobloug A, Nore KG, et al. COVID-19 in an elderly woman with acute functional decline. Tidsskr Nor Laegeforen. 2020;140.
38. Vassiliou AG, Kotanidou A, Dimopoulou I, et al. Endothelial dysfunction triggers acute respiratory distress syndrome in patients with sepsis. Frontiers in Medicine. 2023;10:1203827.
39. Zhu L, He J, Ding R, et al. Sepsis-Induced Endothelial Barrier Dysfunction: Permeability and Regulated Cell Death. Journal of Inflammation Research. 2024;17:8121-8139.
40. Bellani G, Laffey JG, Pham T, et al. Epidemiology, Patterns of Care, and Mortality for Patients with Acute Respiratory Distress Syndrome in Intensive Care Units in 50 Countries (The LUNG SAFE Study). JAMA. 2016;315:788-800.
41. Clancy C.J, Nguyen M.H. COVID-19, superinfections and antimicrobial development: What can we expect. Clin Infect Dis. 2020;71:2736-2743.
42. Getahun H, Smith I, Trivedi K, et al. Tackling antimicrobial resistance in the COVID-19 pandemic. Bull World Health Organ. 2020;98:442-442A.
43. Paranjpe I, Fuster V, Lala A, et al. Association of treatment dose anticoagulation with in-hospital survival among hospitalized patients with COVID-19. J Am Coll Cardiol. 2020;76:122-124.
44. Tang N, Bai H, Chen X, et al. Anticoagulant treatment is associated with decreased mortality in severe coronavirus disease 2019 patients with coagulopathy. J Thromb Haemost. 2020;18:1094-1099.
45. The RECOVERY Collaborative Group, Horby P, Lim WS, et al. Dexamethasone in hospitalized patients with Covid-19. N Engl J Med. 2021;384:693-704.
46. Henry B.M, de Oliveira M.H, Benoit S, et al. Hematologic, biochemical and immune biomarker abnormalities associated with severe illness and mortality in coronavirus disease 2019 (COVID-19): a meta-analysis. Clin. Chem. Lab. Med. 2020;58:1021-1028.
47. Stone JH, Frigault MJ, Serling-Boyd NJ, et al. Efficacy of Tocilizumab in patients hospitalized with Covid-19. N Engl J Med. 2020;383:2333-2344.