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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 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.

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TEN-YEAR TRENDS IN REVASCULARIZATION, IN-HOSPITAL TREATMENTS, AND OUTCOMES IN PATIENTS WITH STEMI

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Abstract.

Background: Reports on the care of patients with ST-Elevation Acute Mycoardium Infarction (STEMI) from low- or middle-income settings are scarce. And trend analysis, from long-term studies, are even scarcer.

Objective: we sought to report changes in revascularization, in-hospital treatments, and outcomes of patients with STEMI admitted in the last ten years, included in the REgistro de Sindromes Coronarios AgUdos (RESCUE) database, from a middle-income scenario without coronary intervention

Methods: The RESCUE database (2014 to December 2023) was queried to identify all STEMI hospitalizations. Temporal trends, outcomes, demographics, revascularization, in-hospital and discharge medications in these patients were determined. Also, overall defect-free care, a composite measure capturing use of guideline-directed medical therapy (GDMT) at admission and at discharge was reported.

Results: Among 1456 patients with STEMI, there was significant increase in fibrinolytic administration (58.2% in 2014-2016 vs 70.3% in 2021-2023, $P \leq 0.01$). Overall defect free care composite at admission and at discharge was only achieved in 37.4% and 74.3% of patients, respectively. Administration of Aspirin, Clopidogrel, statin, Angiotensin Converter Enzyme Inhibitor (ACEI), Beta-blocker (BB) was 98.6%, 98%, 98.1%, 92.4%, 61.7%. At discharge, it was 97.9%, 96.1%, and 95%, 96.7% and 80.7%. Unadjusted in-hospital mortality decreased from 2014-2016 to 2021-2023 (14%–7.7%, P= 0.012). However, risk-adjusted mortality rate increased significantly (5%–8.9%, P<0.001).

Conclusion: There has been a steady improvement in process measures and a high adherence to GDMT in this population. In-hospital mortality has remained stable, despite not having defect-free care in most patients. The RESCUE registry continues to play an important role in improving healthcare delivery and patient outcomes in this location.

Key words. Trends, acute coronary syndrome, revascularization, STEMI.

What is known.

• In last years, there have been noteworthy improvements in care for patients with acute myocardial infarction (AMI) in low- and middle-income scenarios.

• However, there is limited data on change in patients' characteristics and impact of the process improvements on outcomes of patients with AIM in these circumstances.

What does this study add.

• The study provides understandings about time-based trends in patients characteristics, changes in revascularization, and use of guideline-directed medical therapy in patients with AMI in a particular middle-income scenario, without coronary intervention.

• Despite the improvements in medical therapy and process, the risk-adjusted mortality in ST-segment elevation myocardial infarction has remained still high. The monitoring of data related to the care process can ultimately modify it, indirectly.

Introduction.

The analysis of trends in records of patients with Acute Myocardial Infarction (AMI) is a fundamental tool in clinical practice, since it allows the identification of patterns and risk factors that can influence the prognosis and evolution of patients [1-3]. Through the systematic study of demographic, clinical and therapeutic data, emerging trends and variations in the treatments used can be detected, which contributes to improving the quality of medical care [4-6].

In middle-income countries, where health resources are usually limited, the analysis of trends in registries of patients with AMI, and specifically ST segment Elevation Myocardial Infarction (STEMI) takes on even greater relevance [7-8]. As these countries face additional challenges in terms of access to specialized healthcare and availability of advanced treatments, identifying patterns and best practices through data analysis can be crucial to optimize existing resources and improve clinical outcomes.

By delving into trends in treatments and outcomes of patients with AMI, opportunities can be identified to implement more effective and personalized interventions, adapted to the specific needs and characteristics of the population. This can not only lead to better individualized care, but also to an optimization of healthcare resources and a reduction in the economic burden associated with the treatment of this disease [9].

Although there are care networks for patients with STEMI in Cuba, there are not many reports on patient characteristics or treatment received by them. A recent review only located 17 reports suitable for analysis, and of these only two presented data from more than 1000 patients, and only one presented data for a period greater than 5 years [10]. Therefore, it is established that trend analysis reports are not frequent in this country. However, the Registro Sindromes Coronarios AgUdos (RESCUE) [11] provides a 10-year perspective of the

characteristics, management, and clinical outcomes of patients with ST-segment elevation myocardial infarction (STEMI) in Sancti-Spiritus, a province of the center of the country. In this study, we sought to report changes in the treatment of patients with STEMI discharged alive in the aforementioned period.

Methods.

The RESCUE is a regional, ongoing, voluntary registry with emphasis in quality of attention measures, with no sponsor. This registry initially included patients with Acute Coronary Syndromes [11], but in 2018, unstable angina monitoring was abandoned. However, as NSTEMI`s diagnosis requires cardiac biomarkers (troponin monitoring is not allowed) and as this center presented input deficiencies of creatine kinase, its diagnosis has been stopped since 2021.

Details of the design and conduct of the registry have been previously described before [11,12]. The inclusion of data in this registry was approved during three years by an institutional review board in 2014, 2019, and recently in 2024, with 2 prorogues of two years in 2017 and 2022. Definitions for the data elements of the registry are available at http://genetica.ssp.sld.cu/rescue/descargas/RESCUE%20Manual%20de%20Usuario.pdf

Study Population: Inclusion and Exclusion Criteria.

We reviewed consecutive STEMI patient records in RESCUE registry from June 2014 to December 31, 2023. The data collection form (DCF) version 2.1 began in January 2018 with some changes in data elements as compared to original DCF version. To provide uniformity of data definitions, results of these parameters will be presented and analyzed, but no trend will be shown as a result. In addition, duplicate records with the same and non-missing of date of birth, sex, health sector, (n=74) were excluded. This resulted in the records from 1456 unique patients from June 2014 to December 2023 who were included in the analysis.

Data.

The data concerning risk factors of admitted patients were questioned by the treating physician of each patient according to regional and national standards. To determine gender, the patient's declaration was used at the time of requesting the national identity document. To determine an increasing or decreasing trend of the elements to be studied, the records of the first three years of the study (2014-2016) were compared with those of the last three years (2021-2023). We report on overall defect-free care, a composite measure capturing use of guideline-directed medical therapy (GDMT), measurement of left ventricular systolic function, time to reperfusion therapy and referral to cardiac rehabilitation in eligible patients.

GDMT was described at admission and at discharge. GDMT at admission included aspirin and clopidogrel at arrival, administration of fibrinolytic and beta-blocker, statin and Angiotensin-Converting Enzyme Inhibitor (ACEI) started within 24 hours after admission; and at discharge encompassed aspirin, clopidogrel, statin, ACEI (regardless of left ventricular function) and betablocker (with emphasis on those with left ventricular dysfunction).The prognostic variables included in this report were: presence of some degree of Heart Failure (including cardiogenic shock); mechanical complications (rupture of septum, rupture of free wall, rupture of papillary muscle); ischemic recurrence; atrioventricular block greater than Mobitz 2, or requiring the placement of a temporary or permanent pacemaker; malignant ventricular or supraventricular arrhythmias that required emergency management by medical personnel; and death of the patient.

Risk-adjusted mortality rate (RAMR) was defined as follow: age > 70 years, systolic blood pressure < 100 mmHg, more than 7 leads affected; KK IV and high grade BAV all with 1 point, FV-TV (2 points) and glomerular filtration < 60 ml/min (3 points). This scale showed good sensitivity and specificity with excellent predictive capacity (AUC 0.928) and good calibration ($p = 0.778$) [13].

Data elements are presented as frequencies and or percentage for categorical variables and median (some along with Q1, Q3) for continuous variables. Continuous variables were compared using the Student's t-test and are reported as mean ± SD or median (interquartile range [IQR]) depending on whether they were normally distributed or not. Effect sizes were expressed using odds ratios (ORs) and 95% confidence intervals (CIs). Associations were considered significant if the p value was <0.05. We used SPSS Statistics for Windows version 24.0 (IBM, Armonk, New York) for all statistical analysis.

Results.

From June 2014 to the end of December 2023, 1,566 patients were admitted to the Coronary Care Unit of the Camilo Cienfuegos General Hospital, of which at least data related to age, sex, and health area were reported in 1,456. All health areas of the province had at least one admission/year of study in this period.

The average annual admission to the center was 154 patients per year (12.8 patients/month). The year with the highest number of admissions was 2020 and the year with the least admissions was 2023 (178 and 130 admissions respectively; during 2014, data was only collected since June), as presented in Table 1.

Major cardiovascular risk factors didn't significantly change, though a constant increased trend is observed in some of them, as prevalence of diabetes mellitus (from 30.7% in 2014-2016 vs 33.2%, p= 0.46), hypertension (from 81.8% in 2014-2016 vs 86.4% in 2021-2023, p= 0.07). However, median age decreased (from 66.4 years in 2014-2016 vs 64.9 years in 2021-2023, P= 0.1), as well as prevalence of patients with chronic coronary syndromes (from 34.5% in 2014-2016 vs 29.1% in 2021-2023, P=0.1) and active smoking status (from 55% in 2014-2016 vs 38.1% 2021-2023, $P \leq 0.01$), as presented in Figure 1.

Reperfusion Strategy: Among patients eligible with STEMI, there was significant increase in fibrinolytic administration (58.2% in 2014-2016 vs 70.3% in 2021-2023, $p \leq 0.01$). From 2014 to 2019, the average delay time of the system for its administration decreased from 119 minutes to 76. However, starting in 2020, and with the appearance of the COVID-19 pandemic, an increase is observed from 84 minutes. in 2020 to 108 in 2022. The year 2023 closed with an average of 96 minutes. PCI during in-hospital admission was performed in 59 patients (3.95%), and of these, only 12 (0.8%) were primary. No CABG was performed during admission despite having proper

Table 1. *Trends in Demographics, Revascularization, In-hospital and Discharge Medications, and In-Hospital Outcomes in Patients With STEMI.*

	n	Over-all	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	p
		1456	**69**	**146**	**136**	**136**	**167**	**154**	**178**	**162**	**178**	**130**	
- DEMOGRAPHICS													
Age	Median	66.0	66.0	69.0	66.0	67.0	64.0	67.0	66.0	64.0	66.0	66.0	0.755
	25th	57.0	57.0	53.0	58.0	57.0	57.0	59.0	57.0	56.0	57.0	57.0	
	75th	75.0	76.0	78.0	76.0	77.0	73.0	73.0	74.0	74.0	74.0	76.0	
Male, %		69.1	65.2	68.5	70.6	69.9	69.5	69.5	69.7	72.8	65.2	68.5	0.96
BMI Kg/m2	Median	25.46	25.7	25.3	25.3	25.8	25.1	24.8	25.8	26.0	25.7	25.5	0.011
	25th	23.18	23.7	22.7	22.8	23.0	22.5	22.9	23.9	24.3	23.4	23.9	
	75th	27.86	27.1	28.7	27.9	27.7	27.8	27.7	28.7	27.9	28.1	27.7	
- MEDICAL HISTORY													
Current smoker, %		49.6	43.5	57.5	58.1	55.9	62.9	53.2	48.9	42.6	34.3	37.7	0.001
Hypertension, %		84.5	73.9	78.1	89.7	91.2	84.4	79.2	84.8	85.2	88.2	85.4	0.006
Diabetes, %		29.1	29.0	34.2	27.9	32.4	22.2	26.6	21.3	31.5	33.7	34.6	0.059
Dialysis, %		0.5	0.0	1.4	0.0	0.7	0.6	1.3	0.0	2.5	0.6	0.8	0.015
Prior CAD, %		29.9	33.3	37.0	32.4	41.9	19.2	22.7	29.8	24.7	31.5	31.5	0.001
Prior MI, %		9.1	14.5	15.1	12.5	13.2	7.2	6.5	6.7	1.9	10.1	7.7	0.001
Prior PCI, %		3.2	0.0	4.8	5.1	2.2	3.0	3.2	1.1	2.5	6.7	0.8	0.032
Prior CABG, %		0.6	2.9	0.0	0.0	0.0	1.2	0.6	0.6	1.2	0.6	0.0	0.263
Prior stroke, %		2.7	2.9	3.4	2.9	2.9	1.2	3.2	1.7	4.9	1.7	2.3	0.681
Peripheral arterial disease, %		3.4	2.9	7.5	2.2	3.7	1.8	1.9	5.1	4.9	0.6	3.8	0.042
- PRESENTATION													
Signs of Heart Failure, %		17.0	39.1	32.2	19.1	16.2	6.6	16.2	16.9	11.1	12.9	14.6	0.001
Signs of Cardiogenic shock, %		3.1	1.4	3.4	5.1	5.9	2.4	3.2	2.2	1.9	1.1	1.5	0.012
Cardiac arrest at first medical contact, %		2.33	0.0	0.0	5.1	0.0	4.2	5.8	2.8	1.2	0.6	0.8	0.001
LVEF ≤ 40%, %		21.3	10.1	18.5	19.1	21.3	13.8	19.5	27.5	20.4	29.2	26.2	0.003
- REVASCULARIZATION													
Overall TT, %		57.6	58.0	56.2	53.7	57.4	57.5	57.1	57.3	58.6	59.0	60.8	0.995
TT without contraindications, %		63.6	65.6	57.8	55.0	59.3	59.4	62.6	66.2	64.1	70.0	79.8	0.007
Median door to needle time, min		60	120.0	120.0	80.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	0.009
Primary PCI		0.7	1.4	0.0	0.7	0.0	0.0	1.3	0.6	0.0	0.0	3.1	0.001
IN-HOSPITAL TREATMENT													
Aspirin use, %		98.6	98.6	97.9	98.5	96.3	99.4	98.7	97.8	99.4	99.4	100	0.279
Clopidogrel use, %		97	94.2	100	99.3	99.3	99.4	99.4	99.4	98.1	83.1	98.5	0.001
ACE inhibitors or ARB		86.9	82.6	86.3	84.6	96.3	96.4	83.8	91.0	91.4	92.1	93.8	0.001
ACE inhibitors or ARB in LVEF <40%, %		83.5	57.1	77.8	84.6	93.1	100	66.7	85.7	78.8	82.7	85.3	0.001
Beta-blocker use, %		61.7	81.2	12.3	60.3	77.2	91.0	62.3	55.6	67.3	64.6	50.8	0.001
Statin therapy, %		98.1	97.1	98.6	100	100	100	100	88.2	99.4	98.9	100	0.001
Defect free care, %		33.7	5.8	8.2	25.7	43.4	53.3	35.7	36.5	40.7	32.6	36.9	0.001
DISCHARGE MEDICATION													
Aspirin use, %		98.1	95.2	96.7	98.3	99.2	98.1	97.8	98.7	100	98.1	96.7	0.404
Clopidogrel use, %		95.9	96.8	96.7	97.5	95.1	96.8	97.1	99.4	97.3	85.1	99.2	0.001
ACE inhibitors or ARB, %		96.7	98.4	91.7	97.5	97.5	99.4	94.2	96.8	96.0	97.5	98.4	0.032
ACE inhibitors or ARB in LVEF <40%, %		94.4	100	92.3	95.2	94.7	100	86.4	97.1	88.9	95.0	96.4	0.665
Beta-blocker use, %		82.6	62.9	44.6	79.0	94.3	95.6	69.8	83.8	96.7	91.3	89.4	0.001
Aldosterone antagonist in LVEF <40%, %		96.6	100	100	100	89.5	95.2	100	100	92.6	92.5	100	XXXX

Statin therapy, %		96.1	79.0	85.1	95.8	100	98.1	98.6	98.7	100	95.7	99.2	0.001
Defect free care, %		74.3	48.4	33.9	69.7	88.5	89.9	63.3	80.5	86.7	75.8	85.4	0.001
IN-HOSPITAL OUTCOME													
Unadjusted mortality, %		10.1	10.1	17.1	12.5	10.3	5.4	9.7	13.5	7.4	9.6	5.4	0.001
Risk-adjusted mortality rate, %		6.66	4.4	4.8	5.4	5.8	3.9	7.9	6.3	11.5	8.2	6.7	0.001
Mortality risk score	Median	1.4	1.0	2.0	1.0	1.0	1.0	1.0	1.0	2.0	2.0	2.0	0.041
	25th	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	75th	3.8	4.0	4.0	4.0	4.0	3.0	4.0	3.0	4.0	4.0	4.0	
Cardiogenic Shock, %		8.5	1.4	6.8	6.6	5.9	7.8	11.0	7.9	10.5	16.3	10.8	0.001
Mechanical complications, %		4.0	4.3	5.5	5.9	5.9	4.2	2.6	5.6	1.9	3.4	0.8	0.001
Major Arrythmia		13.7	2.9	4.1	8.1	7.4	16.2	18.2	16.0	21.1	18.5	15.4	0.001

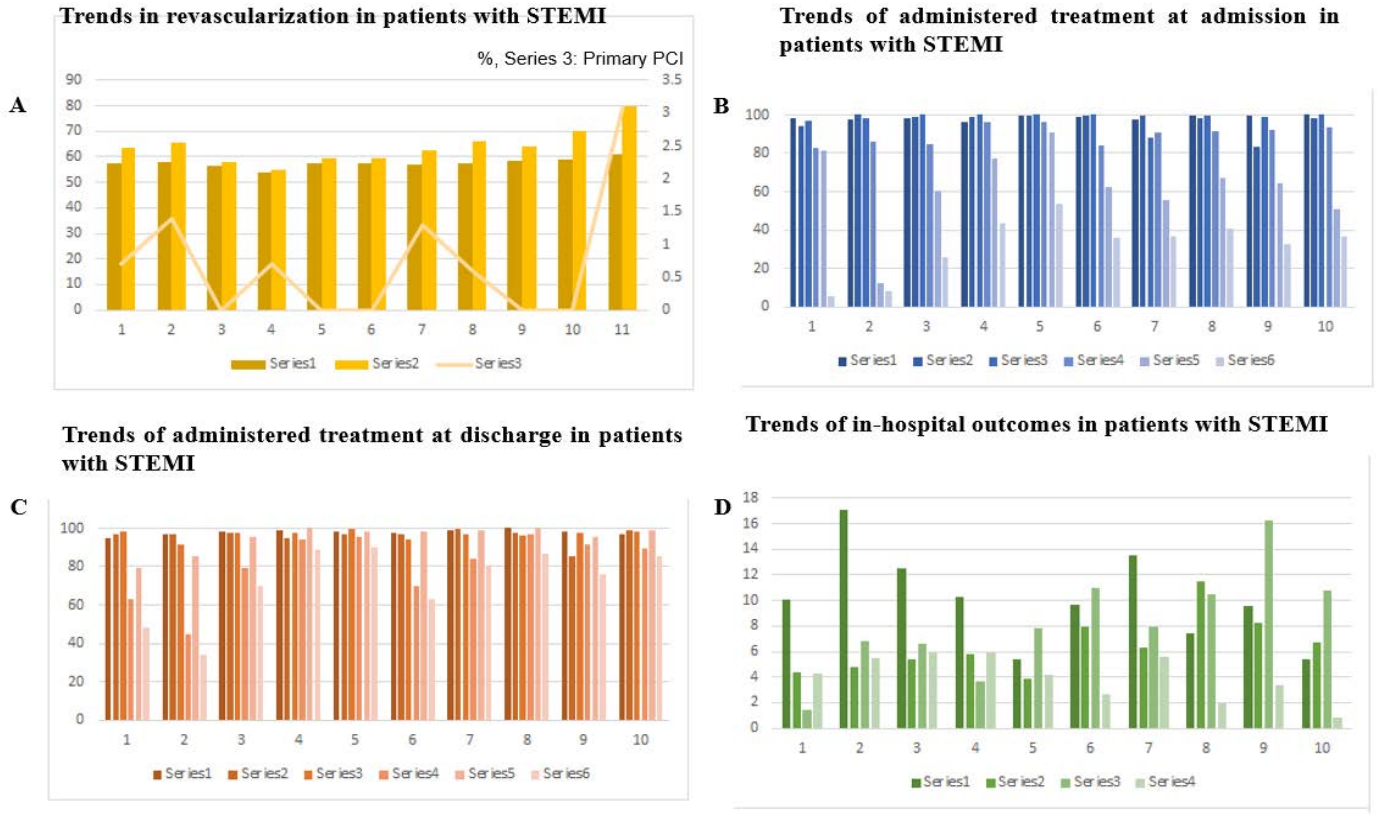

Figure 1. *Trends in revascularization, in-hospital and discharge medications, and in-hospital outcomes in patients with STEMI.*

Panel A. *Trends in revascularization in patients with STEMI: Series 1: Overall TT (%); Series 2: TT without contraindications (%); Series 3: Primary PCI (%).*

Panel B. *Trends of administered treatment at admission in patients with STEMI. Series 1: Aspirin use (%); Series 2: Clopidogrel use (%); Series 3: Statin therapy (%); Series 4: ACE inhibitors or ARB (%); Series 5: Beta-blocker use (%); Series 6: Defect free care (%).*

Panel C. *Trends of administered treatment at discharge in patients with STEMI. Series 1: Aspirin indication at discharge (%); Series 2: Clopidogrel indication at discharge (%); Series 3: Statin therapy indication at discharge (%); Series 4: ACE inhibitors or ARB indication at discharge (%); Series 5: Beta-blocker indication at discharge (%); Series 6: Defect free care (%).*

Panel D. *Trends of in-hospital outcomes in patients with STEMI. Series 1: Unadjusted mortality (%).*

Series 2: *Risk-adjusted mortality rate (%); Series 3: Cardiogenic Shock (%); Series 4: Mechanical complications (%).*

Abbreviations: *ACE: Angiotensin Converter Enzyme; ARB: Angiotensin Receptor Blockade; BMI: Body Mass Index; CABG: Coronary Artery Bypass Graft; CAD: Coronary Artery Diseases; LVEF: Left Ventricle Ejection Fraction; MI: Myocardial Infarction; PCI: Percutaneous Coronary Intervention; TT: Thrombolytic Therapy.*

resources for this procedure, at the reference center (Table 1 and Figure 1)

Medical therapy—in-hospital and at discharge: Overall defect free care composite in first 24 hours of in-hospital stay was only achieved in 37.4% of patients. The year with the lowest and highest adherence to the protocol was 2015 and 2018, with 10.9% and 50.5%, respectively, although with a trend towards improvement (26.5% in 2014-2016 vs 36.6% in 2021-2023, $P \leq 0.01$). The overall administration of Aspirin, Clopidogrel (the only P2Y12 inhibitor available), statin, Angiotensin Converter Enzyme Inhibitor (ACEI), Beta-blocker and fibrinolytic was 98.6%, 98%, 98.1%, 92.4%, 61.7% and 57.6%. Aspirin compliance was above 96% in all years. The statin was administered below 95% in a single year (2020), Clopidogrel in two (2014 and 2022), and the ACEI had a more negative behavior, being administered below 90% in 2 years (2014 and 2019) (Table 1 and Figure 1).

However, the greatest non-compliance was detected in the administration of Streptokinase and beta-blockers. Globally, fibrinolytic administration remained unchanged between 52-58%, exceeding 60% in a single year. If this analysis is carried out excluding those with contraindications, then the frequency of administration rises to minimums close to 60%, with an average value of 64%, with a tendency towards increasing administration (58.2% in 2014-2016 vs 70.3% in 2021-2023, $p \leq 0.01$). The administration of beta blockers in the first 24 hours in patients without contraindications for their use has been more irregular, with a minimum of 12% in 2015, and a maximum of 92% in 2018, but still with an increasing trend (44.4% in 2014-2016 vs 61.7% in 2021-2023, $p \leq 0.01$).

At discharge, the mean administration of Aspirin, Clopidogrel and Atorvastatin was 97.9%, 96.1%, and 95%. This slight decrease with respect to the treatment at admission may be influenced by the presence of secondary events that occurred during the hospital stay. Administration of ACEI at discharge increased slightly compared to its administration at admission, rising to 96.7% (adherence greater than 95% was found in the study years, except in 2015 and 2019, but greater than 90%) without decreasing considerably in patients with heart failure (94.1%, p: 0.3). The administration of beta blockers in patients discharged alive increased 15%, up to 80.7% compared to the treatment at admission. Its administration in the subgroup of patients discharged alive with heart failure was not different (79.9%) (Table 1 and Figure 1)

The administration of other diuretic drugs showed a clearly increasing trend. In the first 3 years of the study, an average of 39.23%, 23.25% and 27% of its administration at admission, at discharge and at discharge in patients with heart failure was reported; while in the last 3 years, 84%, 88.9% and 88.6% were reached, respectively. Finally, intravenous heparin was only noncompliance in 11 patients.

In-hospital outcomes: For patients in this study, unadjusted in-hospital mortality decreased from 2014-2016 to 2021-2023 (14%–7.7%, p= 0.012). However, RAMR increased significantly (5%–8.9%, $p<0.001$) over these periods, and this resulted in a significantly decrease in standardized mortality rate, from a media of 2.8 during 2014-2016 to 0.87 in 2021-2023 ($p \leq 0.01$). Likewise, since 2018 a decrease in this value has been observed, and only in 2020 was it reported above 1.5 (Table 1 and Figure 1)

Heart failure of any degree during admission as very common. Globally, about 1 in 4 patients presents this complication. In the first three years of the study, it was presented in 28.5% of patients in first three years vs 24.9% in last ones. However, those with cardiogenic shock were less prevalent in first three years than in the last ones (9.4% vs 12.8%), although there was no significant difference (p= 0.13). It also occurred with patients with recurrent ischemia (RI) and malignant arrythmias (MA): although with a trend towards increasing prevalence (12% vs 14.9% for RI; and 9.4% vs 11.4% for MA), the differences are not yet decisive (p: = 0.3 for RI; and p= 0.25 for MA).

Only 58 patients (3.98%) presented any mechanical complication. This data was not useful to draw a trend. Two patients with a ruptured interventricular septum were transferred to a reference center, who died during surgery. The rest of the patients with mechanical complications died in the center.

Discussion.

First result of this study was an increasing prevalence of STEMI (21.4 %) in recent years perhaps due to COVID-19 pandemic. This has been previously described in reports of multicenter studies to which this center belongs [13,14]. in the first months of the COVID-19 pandemic a decrease in patients with STEMI was widely informed [15-17]. However, others support the theory that sedentary behaviors, physical inactivity, weight gain, loneliness, financial stress, loss of job, cigarette smoking binges, all triggered by lockdown [18,19], will increase the prevalence of admissions for this and other ischemic conditions such as stroke or pulmonary embolism). This may explain why precisely 2020 was the year with the highest number of admissions due to COVID-19, despite having a decrease in incidence in the first months of the year.

Furthermore, a change in the risk profile of the included patients is noted. By 2023, patients with STEMI tend to be younger, hypertensive and diabetic, although they have stopped smoking. This trend of increasing incidence in younger patients is quite common [20,21]. In Cuba, high blood pressure and Diabetes mellitus continue to be the most reported risk factor [10]. In the absence of more recent research, or one focused on the new risk factors described, this will have to be assumed as the profile of the acute coronary patient in the nation.

The increase in fibrinolytic administration responds to specific strategies of this network, discussed elsewhere [11-14]. It is appropriate to recognize the efforts of the pre-hospital care staff, who led to an evident improvement in medical care for patients with STEMI with a decrease in delay of care times. However, COVID-19 affected the way in which this particular network had been working. Delays in waiting times increased, as well as fibrinolytic administrations decreased in rural and suburban areas in last three years [14].

The absence of PCI and CABG constitute points of necessary improvement in the coming years, which will depend on the implementation of national strategies for this purpose [22]. With the available technology and the appropriate learning curve, very encouraging results can be achieved, reducing fatal complications and emergency referrals to cardiothoracic

surgeries to a minimum. However, this modification in the therapeutic approach for patients with STEMI should not occur in the next 5 years.

Complete adherence to the protocol in the first 24 hours was really low, and although a growing improvement is observed, it is still insufficient. In other low- or middle-income settings, it is common to find a large number of patients with incomplete treatment. On several occasions, this is due to the lack of implementation of specific improvement programs, or monitoring of quality indicators or performance measures [8,23,24].

For some years now, there have been warnings about the low administration of fibrinolytic and beta-blockers in patients with STEMI, and although it has been partially corrected in this particular network, the results from the rest of the country are not very encouraging [11,14].

We also have to mention that the only fibrinolytic available, Recombinant Streptoquinase, is contraindicated in certain patients, but, in this scenario, with low capacity to carry out interventional procedures, pharmacological recanalization is the only possible approach for the rescue of ischemic myocardium. Therefore, efforts must be directed at increasing the rate of its administration [25,26]. However, for a territory of just over 5000 km^2, there are few units where their administration is carried out with minimum conditions.

Even in low- and medium-income settings, the rate of thrombolysis application is decreasing considerably due to the extension of interventional techniques [7,8,22]. But no in this country, where patients treated with an interventional approach constitute the minority, even in cities with centers where this type of treatment is provided [10]. Regarding those that only provide a pharmacological approach, the adherence of this network is one of the highest. Also, the effects of the emergence of the COVID-19 pandemic on care times have been discussed in other documents [13,14,27].

Despite having declared the epidemiological discharge a few months ago, many care units, in rural locations, continue to refer patients to the provincial hospital, before administering the fibrinolytic drug. This practice prevents a decrease in attendance times towards pre-pandemic levels. It should be noted that, in this province, there is still no effective feedback method between the secondary and primary level of care (for these emergencies), so communication of non-compliance with protocols is null.

In this center, and in other similar centers in the country (secondary care level hospitals), short-acting beta blockers are not available. Only propranolol, atenolol and, less commonly, carvedilol are available. Therefore, to start beta-blockers in the first 24 hours, the team responsible for the care of patients in the acute phase of STEMI must carry out adequate risk stratification and a careful analysis of the patient's suitability to start a beta-blocker. It should be remembered that the main societies responsible for issuing consensus documents on care for patients with STEMI have not yet agreed on the usefulness of this kind of drug in patients without heart failure [28,29].

There are also no other options besides clopidogrel for P2Y12 Inhibitor compliance. Although there are no trials of its usefulness in patients without coronary intervention, in this scenario it is provided as preventive therapy. Although, encouraging results in the prevention of ischemic events from the indication of a P2Y12 inhibitor have been reported with its indication in other conditions such as stroke, pulmonary embolism, or peripheral arterial disease [30]. In recent years, there have been periods in which there is no adequate supply of this drug, and therefore, its administration declines.

Despite a notable increase during admission, beta-blockers remain poorly indicated in patients with heart failure at discharge. This may be due to the fact that, during admission, the patients' heart rate decreases, as the level of physical activity decreases, but once they are discharged, the heart rate may increase slightly [31,32]. There are also no reasons for noncompliance with the ACEI dose in the first 24 hours, except in patients with hypotension upon admission. However, this is corrected during admission, its administration being the same as that of aspirin, clopidogrel and statins.

Other diuretics are not clearly indicated in patients with uncomplicated STEMI. Although Potassium-sparing type diuretics have gained a greater level of acceptance, they continue to be underused [33,34]. In the first years of this study, their administration coincides quite closely with the level of congestive complications, and towards the final three years, they were administered quite a bit more than beta blockers.

In this study, in-hospital mortality decreased as pharmacological adherence increased, although this should not be the only cause of this phenomenon [35-37]. And coincidentally, the risk profile of the patients increased. Despite this, in recent years, a mortality rate lower than expected according to the risk of the patients has been observed. This result has not yet been reported in the country, so it is unknown if it is a situation specific to this network, or a national trend. Analysis of reports of REgistro CUbano de Infarto Agudo de MiocArdio [38,39]. (RECUIMA) [Cuban Registry of Acute Myocardial Infarction] show that RAMR has remained stable between 4% and 5.6%. Meanwhile, in-hospital mortality has never been lower than the RAMR. In fact, it has been higher by a factor ranging between 1.5 and 2 times. And it is when the results of this care network are compared with other similar centers in the same country, that the results of the staff of this center are evident, in the containment of in-hospital complications in patients with STEMI.

The increase in the risk-adjusted mortality rate (RAMR) over time, according to the study data, can be attributed to several interrelated factors. One important factor is the change in the risk profile of patients admitted with STEMI. The most recent patients included in the study tend to be younger, with a higher prevalence of hypertension and diabetes. In addition, the higher prevalence of STEMI in recent years could also be a contributing factor. Sedentary behaviors, physical inactivity, weight gain, loneliness, financial stress, job loss, and increased smoking, all triggered by the lockdown during the COVID-19 pandemic, may elevate the risk profile of these patients.

Finally, despite improvements in reperfusion treatment, delay times and the rest of the treatment in the acute phase of acute coronary patients, the prevalence of cardiogenic shock increased in the years of study, although the rise was noticeable before the

emergency of the COVID-19 pandemic, as widely reported [40-42]. Fortunately, this increase in prevalence was not reflected in overall mortality. Regarding the rest of the complications, it stands out that mechanical complications occurred in 4% of the patients. Of course, this value is higher than that of recent registries that use an interventional approach, but it is very similar to that of these same registries before modifying the treatment approach [43,44]. These same records show that the only way to decrease the incidence of these dangerous complications is by modifying the treatment approach. However, this expected change in the therapeutic approach is not expected in the short or medium term. So, the only way to improve the in-hospital prognosis of these patients is the administration of fibrinolytic in the shortest possible time.

Study Limitations.

As stated, this study only included patients admitted with STEMI in a setting form middle-income country where the main treatment approach is pharmacological, with a nationally manufactured fibrinolytic. We also included only in-hospital outcome; collection of long-term patient data, including both data on patient experience of care and patient-reported outcomes, is complex and costly, but increasingly important. Finally, a set of performance measures and quality indicators was recently published by specialists of Cuban Society of Cardiology including center organization reperfusion, antithrombotic treatment, secondary prevention, and outcomes, with the goal to improve quality of care in patients with AMI in this country. It remains to determine the effect of the application of these indicators on the quality of care of patients with STEMI.

Conclusion.

This report provides temporal trends in patient characteristics, and care of patients with STEMI in a single center in Cuba and confirms that there has been a steady improvement in process measures and high adherence to GDMT in this patient population. The in-hospital mortality has remained stable for patients with STEMI, despite not having defect-free care in most patients. The RESCUE registry continues to play an important role in performance improvement efforts across this region and must play a substantial role for improving healthcare delivery and patient outcomes.

Contributor Roles Taxonomy: Conceptualization: MARR; Data curation: WCdlP, DAG, MGS; Formal Analysis: MPG; Methodology: MSM, GMG; Project administration and Supervision: MARR; Writing – original draft: WCdlP, DAG, MGS, MPG; Writing – review & editing: MARR, MSM, GMG.

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