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Clinical and Economic Effectiveness of CT Angiography Methods in the Emergency Department for Intermediate-Risk Patients With Non-ST-Segment Elevation Acute Coronary Syndrome

Aim — The aim of this study was to evaluate the clinical and cost-effectiveness of computed tomography angiography (CTA), which includes CT coronary angiography and a «triple rule-out» protocol, in intermediate-risk patients with suspected non-ST-segment elevation acute coronary syndrome (NSTEACS) in the emergency room (ER) of the regional vascular center in the structure of a multidisciplinary hospital in Moscow.

Material and methods — This continuous single-site study included patients hospitalized in a multidisciplinary hospital with a referral diagnosis of NSTEACS within 69 days. Patients at intermediate risk who met the inclusion criteria underwent CTA after the initial examination in the ER. If coronary artery disease or an alternative significant diagnosis was excluded, patients were discharged from the hospital on the day of admission. As a comparison method, the costs of treating these patients were assessed if a standard protocol was used. According to this protocol, patients, after the initial examination, were hospitalized in the intensive care unit for patients with myocardial infarction (ICU-MI) and then in the cardiology department for observation and further examination. Clinical economic analysis was performed using the cost minimization method and the tariff method of cost estimation.

Results — For 69 days, 289 patients (59.5% men, mean age 71.7±8.6 years) were admitted to the ER with a referral diagnosis of NSTEACS. In 30 of them, a non-cardiological disease was identified that required routing to other specialized units. 37 (14.3%) of intermediate-risk patients underwent CTA. In 27 of them (10% of all patients), no significant coronary stenosis, signs of pulmonary embolism (PE), or aortic dissection were detected, and the patients were discharged from the ER. 10 patients (4% of all patients) who had significant coronary artery stenoses, PE, or aortic dissection were hospitalized. 72 intermediate-risk patients had exclusion criteria for CTA. The economic benefit from using CTA for excluding ACS in the ER, as compared to the standard approach, was 1,602,450 rubles for the study period. The estimated benefit per year was 8,476,728 rubles.

Conclusion — The introduction of CTA and the «triple rule-out» protocol for intermediate-risk patients in the ER can significantly improve the process of excluding the diagnosis of NSTEACS, reduce the number of unnecessary hospitalizations and optimize the use of hospital capacity. According to the results of our study, this approach is applicable in at least 14% of patients with suspected NSTEACS (at least 33% of intermediate-risk patients).

Keywords — ACS; coronary CT; emergency room; triple rule-out protocol

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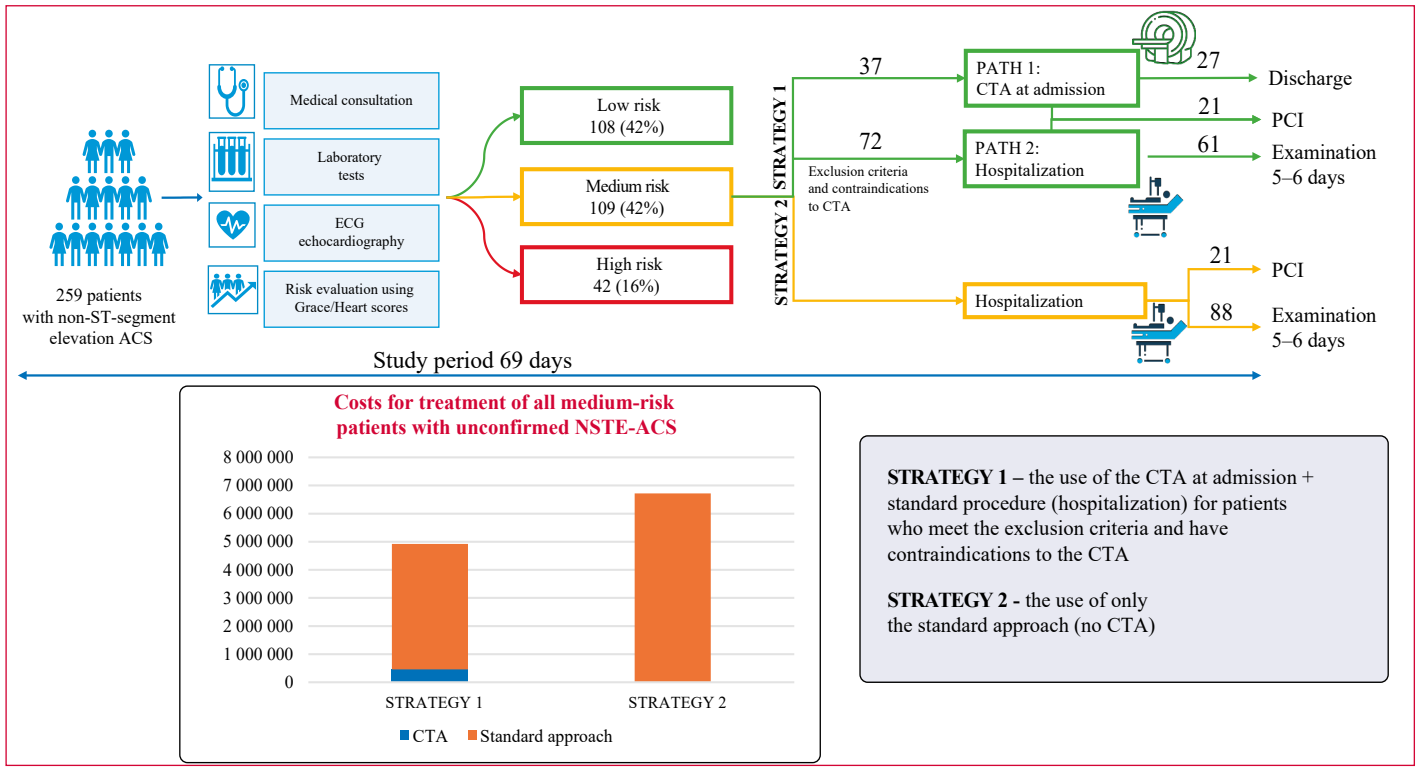
Central illustration. Clinical and Economic Effectiveness of CT Angiography Methods in the Emergency Department for Intermediate-Risk Patients With Non-ST-Segment Elevation Acute Coronary Syndrome



ACS, acute coronary syndrome; ECG, electrocardiography; CTA, computed tomographic angiography, which includes CT coronary angiography and the triple rule-out protocol; PCI, percutaneous coronary intervention; NSTE-ACS, non-ST-segment elevation acute coronary syndrome.

Introduction

Acute coronary syndrome (ACS) is a collective term used to describe a group of diseases and conditions that are caused by disturbances in coronary blood flow and are accompanied by signs of ischemia, with or without an acute elevation of blood troponin levels. ACS represents an acute form of coronary artery disease and is among the most prevalent causes of mortality among individuals over the age of 35 [1].

ACS is the admitting diagnosis that requires prompt evaluation in the emergency department (ED) setting. In patients with a referral diagnosis of ACS, acute cardiovascular pathology can be excluded; they can be diagnosed with acute myocardial infarction, unstable angina, or other conditions such as pulmonary embolism (PE), acute aortic syndrome (AAS), and any other acute cardiovascular conditions. Nevertheless, acute chest pain is frequently a condition that does not necessitate hospitalization and may be due to the presence of factors such as esophageal spasm, anxiety disorders, and others.

The diagnosis and management of patients with suspected ACS requires a multidisciplinary team with the requisite training and expertise. This includes cardiologists, intensive care specialists, X-ray endovascular surgeons, specialists in functional diagnosis and diagnostic radiology.

The primary task is to ascertain which patients require emergency invasive treatment, specifically those presenting with ST-segment elevation ACS (STE-ACS) and very high-risk non-ST-segment elevation ACS (NSTE-ACS). It is imperative that these groups of patients be immediately hospitalized and transported to the X-ray operating room within 20 minutes of arrival. Up to 70% of patients with suspected ACS can be categorized as medium or low risk after undergoing electrocardiogram (ECG) registration, medical history intake, and clinical and physical examinations. In order to facilitate the prompt determination of appropriate treatment strategies in the ED setting, the European Society of Cardiology has proposed a protocol that entails the measurement of two samples of high-sensitivity troponin within an hour, with ECG recording [2]. The utilization of a short troponin (rule-in-rule-out) protocol has exhibited high efficacy and safety in real-world clinical settings, with a low incidence of cardiovascular events within 30 days of hospitalization [3, 4].

Patients who do not meet the rule-in-rule-out criteria require further follow-up. The American Society of Cardiology categorizes these patients into a watch-

and-wait group? For example if they have exhibited no notable increase or decrease in troponin levels, as evidenced by two positive test results, or in the absence of troponin elevation combined with the presence of risk factors and uncertain electrocardiogram (ECG) alterations. In this cohort of patients, supplementary diagnostic modalities are important, including computed tomographic angiography (CTA), which encompasses CT coronary angiography and the triple rule-out protocol (CT aortography, CT coronary angiography, and CT angiopulmonography in a single examination with a single injection of contrast agent) [5, 6].

A number of studies have demonstrated that the utilization of CTA in the ED setting for patients at low and medium risk of ACS results in a higher proportion of patients being managed outpatiently and a reduction in the length of hospitalization, which is reflected in the 2020 and 2023 European Society of Cardiology guidelines [7–9]. Nevertheless, a consensus has yet to be reached regarding the specific indications for CTA in the ED setting. The primary constraints are the elevated expense of the investigation and the necessity for 24/7 accessibility of expert-level diagnostic radiological examinations with prompt result interpretation [10]. There is a paucity of research examining the clinical and economic viability of utilizing CTA at the ED stage in patients presenting with suspected ACS.

Objective

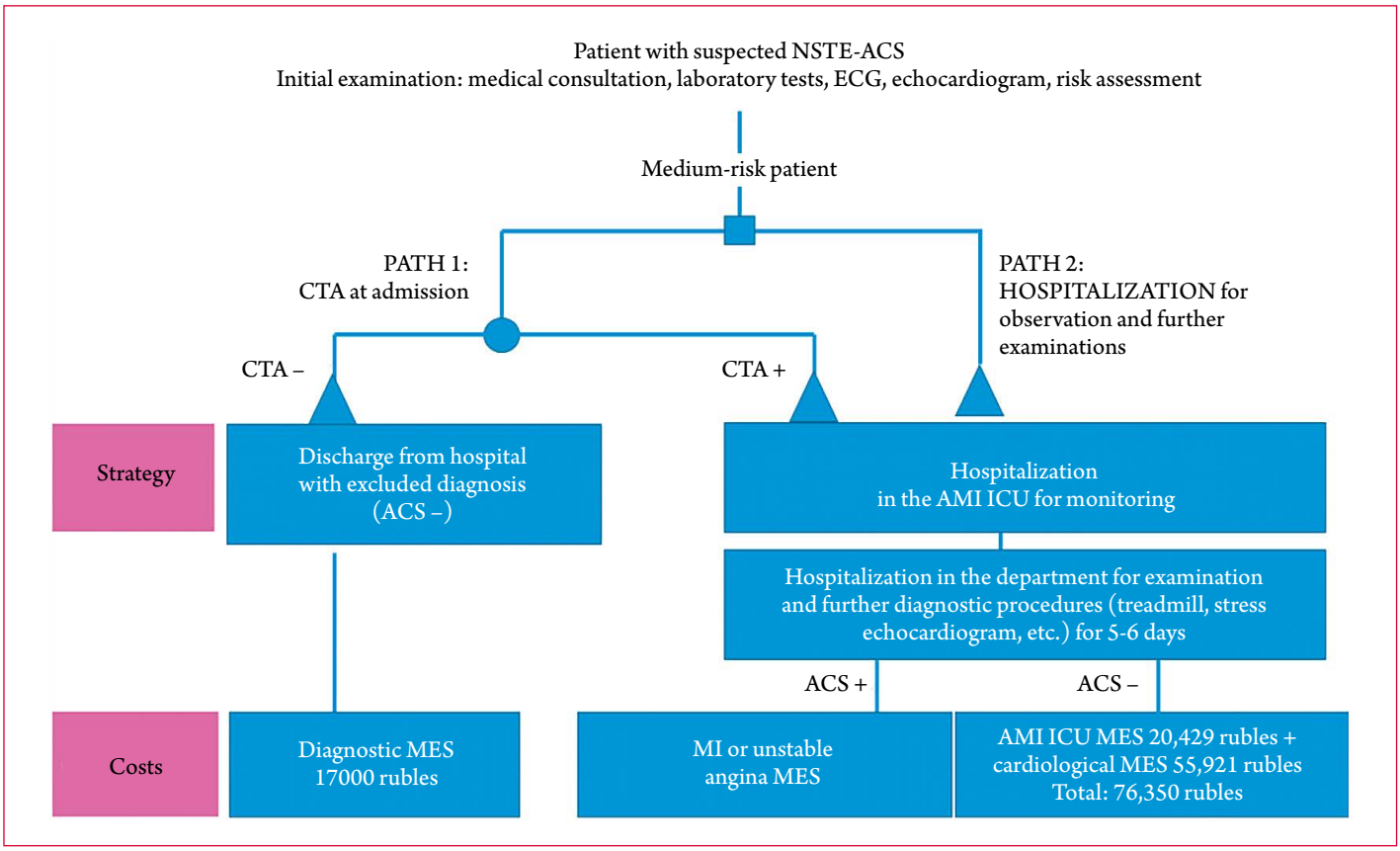
The objective of the study was to evaluate the clinical and economic efficiency of CTA application in patients with suspected medium-risk NSTE-ACS in the ED of a regional vascular center (RVC) of a multidisciplinary hospital in Moscow.

Material and Methods

The continuous single-center study included patients admitted to a multidisciplinary emergency hospital with a referral diagnosis of NSTE-ACS who met the established inclusion criteria.

Upon admission, all patients underwent examination by an internist and myocardial infarction intensive care specialists. Laboratory and clinical investigations were conducted, including a complete blood count, troponin T

Figure 1. Decision tree for patients with suspected medium-risk NSTE-ACS after initial evaluation



Path 1: Admission and exclusion of significant coronary artery disease (CAD -), PE, and AAS – patient discharge;
Path 2: Absence of CTA and possibility of CAD exclusion at admission, hospitalization in the AMI ICU, transfer to the cardiology department, and diagnosis revoked or confirmed within 5–6 days. NSTE-ACS, non-ST-segment elevation acute coronary syndrome; ACS, acute coronary syndrome; ECG, electrocardiogram; MES, medical and economic standard; MI, myocardial infarction; AMI ICU, acute myocardial infarction intensive care unit; CTA, computed tomographic angiography (CT coronary angiography and triple rule-out protocol).

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or troponin I, creatinine, electrocardiography (ECG), and echocardiography with mandatory assessment of left ventricular ejection fraction. In cases where PE or AAS was suspected, D-dimer was also measured. The examination was conducted in the RVC within the shock ward, which forms part of the AMI ICU and is located within the ED. Based on a comprehensive assessment of clinical, laboratory, and examination data, as well as the risk of adverse outcome according to the HEART and GRACE scales, a decision was made by the physician of the AMI ICU to perform CTA for medium-risk patients or the triple rule-out protocol, in accordance with the indications and contraindications for the examination (please refer to Table 1 in the supplementary materials available on the journal's website.).

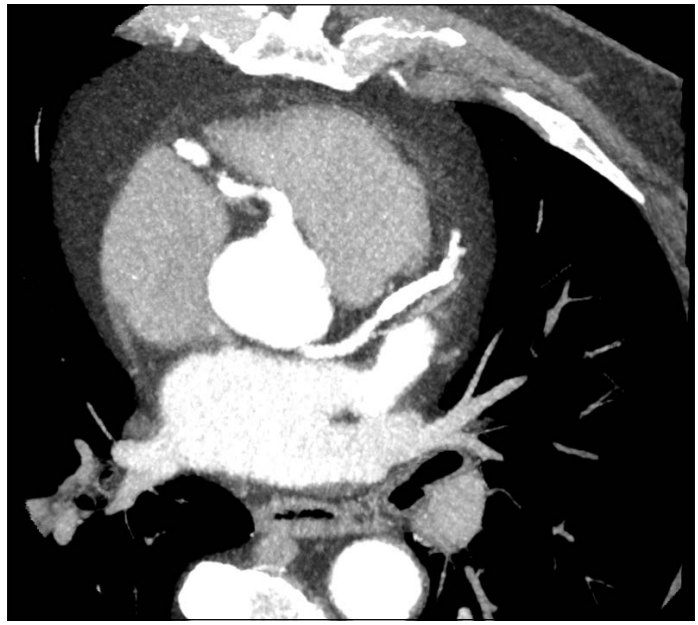
The comparison was made with the standard approach, in which a medium-risk patient with suspected NSTE-ACS after primary examination in the ED setting is hospitalized to the AMI ICU for monitoring and then to the cardiology department to confirm or remove the diagnosis of ACS using additional methods of examination (exercise ECG, stress echocardiography, invasive coronary angiography) without the use of CTA (Figure 1).

Two discrete patient groups in whom the diagnosis of ACS was excluded were analyzed to estimate the associated costs.

In group 1, the approach with CTA at admission (Path 1) is used: the cost of diagnosis and treatment of the patient, including primary diagnosis (medical consultation, laboratory tests, ECG, echocardiogram, etc.), as well as CTA performed to exclude ACS, corresponds to the diagnostic-therapeutic medical and economic standard (MES) tariff and amounts to 17,000 rubles (Attachment No. 2 to Supplemental Agreement No. 13, dated August 21, 2023, to the 2023 Tariff Agreement dated December 30, 2022) and fully covers it.

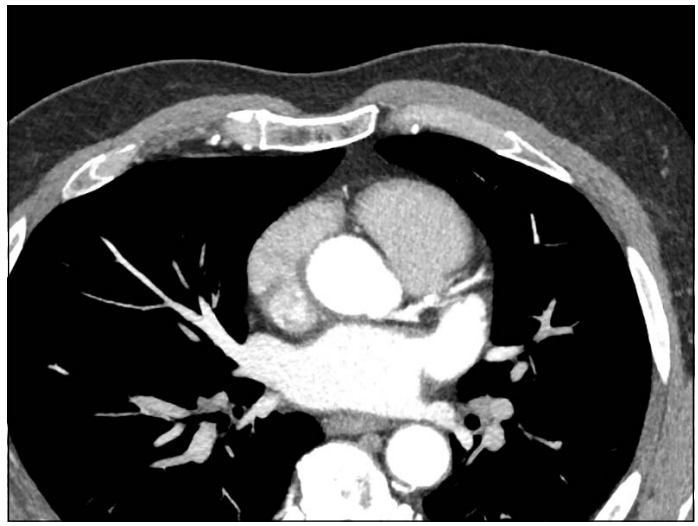
In group 2: the standard approach (Path 2): the cost of diagnosis and treatment of the patient, including the initial diagnosis and all diagnostic and other measures in the department, amounted to the cost of stay in the AMI ICU of 20,429 rubles (Annex No. 8.1.1 to the 2023 Tariff Agreement dated December 30, 2022) and the cost of cardiac MES, with which the patient was discharged from the department in case of unconfirmed diagnosis of ACS (55,921 rubles). Where 55,921 rubles is the average cost of all MES, such as hypertensive heart disease, chronic heart failure (CHF), various forms of CAD, cardiomyopathies, atrial fibrillation (AF) and others, with which patients with unconfirmed diagnosis of ACS were discharged during the period of analysis (Annex No. 8.2 to the 2023 Tariff Agreement dated December 30, 2022). Consequently, the aggregate cost incurred when employing the standard approach (Path 2) to exclude the diagnosis of ACS is 76,331 rubles.

Figure 2. ECG-synchronized CT coronary angiography of 68-year-old patient with HR of 80 bpm



No coronary artery stenosis was detected.

Figure 3. ECG-synchronized CT coronary angiography of 68-year-old patient with HR of 80 bpm



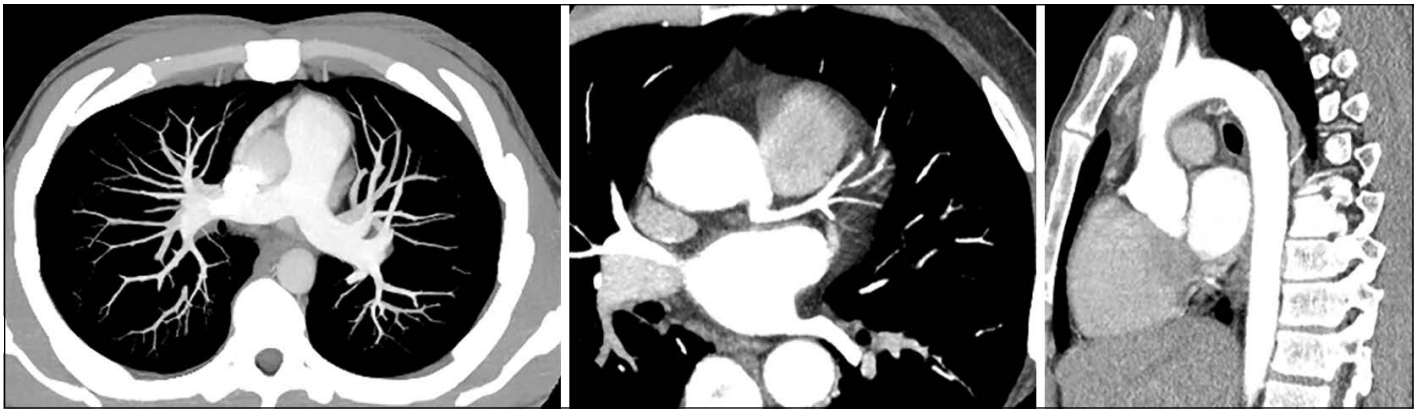
Subocclusion of the left anterior descending artery (LAD), emergency coronary angiography – stenting of the LAD.

The MES «myocardial infarction» or «unstable angina pectoris» was employed to substantiate the diagnosis of ACS when either of the two examination algorithms were utilized. A cost analysis of confirming the diagnosis of ACS is not within the purview of the present analysis.

CTA protocol

All patients included in the study provided voluntary informed consent. All patients with indications and without contraindications underwent ECG-synchronized CTA on

Figure 4. Triple rule-out protocol: angiopulmonography, CT coronary angiography and aortography of a patient with suspected NSTE-ACS



No evidence of contrast-enhancement defects of the pulmonary artery and its branches, stenosis of the coronary arteries, or aortic dissection/intramural hematomas was identified.

a 512 slice Revolution CT scanner (GE Healthcare, USA) with a detector width of 160 mm and a gantry rotation time of 0.28 seconds. The scanner was operated with intelligent software for motion artifact correction and high spatial resolution according to the 1 BEAT protocol for CT coronary angiography and the triple rule-out protocol for evaluation of the aorta, coronary arteries, and pulmonary arteries with a single injection of 50–80 mL of contrast agent using a dual volume injector (Figures 2, 3).

In the triple rule-out protocol, angiopulmonography was conducted using multislice mode with a detector width of 40 mm, a field of view (FOV) of 40 cm, a slice thickness of 2.5 mm, and subsequent reconstruction of the acquired images.

Cardiac scans were conducted with the table remaining stationary in ECG synchronization mode during a single breath-hold per cardiac cycle, irrespective of heart rate (HR). In patients with higher HR, motion artifact correction software (SnapShot Freeze; GE Healthcare) was employed.

Aortography was conducted concurrently to exclude any potential aortic pathology. This was performed in multislice mode with ECG synchronization, a detector width of 80 mm, a DFOV of 40 cm, and a slice thickness of 2.5 mm. The obtained images were subsequently reconstructed (Figure 4).

The investigations were conducted by radiologists with one to nine years of experience in cardiovascular imaging, employing a specially developed short protocol. In the event that coronary artery stenosis of over 50% or other significant pathology (e.g., PE, aortic dissection) was identified concurrently with the corresponding clinical picture and laboratory data, the patient was admitted to the AMI ICU for the purpose of determining the necessity of myocardial revascularization or other interventions. In the absence of other indications for hospitalization and in the presence of intact coronary arteries or stenosis of less than 50%, as well as the exclusion of other significant pathology, the patient could be discharged from the hospital.

In the event of inconclusive data from the CTA and the identification of additional significant pathology, the patient was admitted to the AMI ICU or cardiology department, as determined by the AMI ICU physician.

Furthermore, medical encounters that occurred within six months of the patient's inclusion in the study were subjected to analysis.

Clinical and economic analysis

A retrospective analysis of 259 case records of patients admitted to the RVC over a 69-day period was conducted to evaluate the cost-effectiveness of CTA use in the ED. Given the established efficacy of CTA in identifying significant coronary lesions in patients with ACS, which is comparable to the standard approach, a cost-minimization methodology was employed to conduct the medical and economic analysis [11, 12].

The analysis included a calculation of the cost of patient treatment. The costs of treatment of all admitted medium-risk patients with unconfirmed NSTE-ACS at admission in the AMI ICU and cardiology department (standard approach) were taken into account in comparison with the costs of treatment of this group of patients using CTA methods and the triple rule-out protocol at the ED stage for the specified observation period. The tariff method was employed for the calculation of costs. The advantage of this method in this study is attributed to the nature of municipal health care facility financing. To illustrate, the cost of the treatment of a specific patient (a completed case) is equivalent to the cost of the corresponding tariff. Reimbursement will be made for the tariff at which a specific patient is treated, but not the cost of a singular investigation, inclusive of CTA. CTA, in addition to other diagnostic techniques and therapeutic interventions, is

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incorporated into the tariff and therefore not remunerated as a separate procedure.

All potential categories of costs can be classified into three principal groups.

Costs for patients with confirmed NSTE-ACS

Costs for patients with unconfirmed NSTE-ACS at hospitalization for further examination (standard approach)

Costs for patients with unconfirmed NSTE-ACS at admission using CTA imaging

In accordance with the aforementioned, the formula for calculation by the cost minimization method is as follows:

$$CMA = A - B,$$

where CMA represents the cost difference indicator, A denotes the direct and indirect costs associated with Method 1, while B represents the direct and indirect costs associated with Method 2.

In light of the fact that both indirect and direct costs are already incorporated into the cost of the MES, we may derive the following formula:

$$CMA = (A1+A2) - (B1 + B2 + B3),$$

where A1 is the mean cost of the MES for patients with unconfirmed NSTE-ACS, A2 is the cost of the MES for patients with the confirmed diagnosis; B1 is the mean cost of the MES for patients with unconfirmed NSTE-ACS (patients who met exclusion criteria or had contraindications to CTA); B2 is the cost of the MES for patients with the confirmed diagnosis; B3 is the cost of the MES for patients with an unconfirmed diagnosis when CTA or the triple rule-out protocol is used.

In consideration of the fact that the number of confirmed cases with NSTE-ACS in the two groups will be identical (A2=B2), the following formula is employed:

$$CMA = A1 - (B1+B3).$$

The cost of treating patients with unconfirmed NSTE-ACS determined by calculating the mean cost of the MESs under which patients were treated based on data from Attachment No. 8.1 to the 2023 Tariff Agreement dated December 30, 2022, using the following formula:

$$(\text{number of MES1} + \text{number of MES2} + \ldots + \text{number of MESn})/n,$$

where n is the total number of MESs with which patients were discharged [12, 17].

A separate CTA cost calculation was not performed due to the introduction of the diagnostic therapeutic MES, which includes CTA, in August 2023. The cost of a case with unconfirmed NSTE-ACS using CTA imaging was set to be equivalent to the cost of the specified MES – Annex No. 2 to the Supplementary Agreement No. 13 dated August 21, 2023 – Tariff Agreement for the remuneration for medical care provided under the 2023 Moscow Territorial Program of Compulsory Medical Insurance dated December 30, 2022.

The financial burden associated with a case of unconfirmed NSTE-ACS utilizing the standard approach (hospitalization for further examination) was calculated by incorporating the time spent in an AMI ICU (the Intensive Care tariff of the first category of complexity) and the mean MES for diagnoses with which the patients were discharged (e.g., hypertension, chronic heart failure, atherosclerotic heart disease, and others), in accordance with Appendix No. 8.1 of the Tariff Agreement for the remuneration of medical care provided under the 2023 Moscow Territorial Program of Compulsory Medical Insurance, dated December 30, 2022.

Additionally, the current tariff system for CT examinations encompasses two distinct categories: native CT of a single anatomical region and contrast-enhanced CT of a single region, as outlined in Appendix No. 8.2 of the 2023 Tariff Agreement dated December 30, 2022. Based on these principles of tariffication and interpretation, the costs of CTA and the triple rule-out protocol are equated and correspond to the tariff of contrast-enhanced CT of a single region.

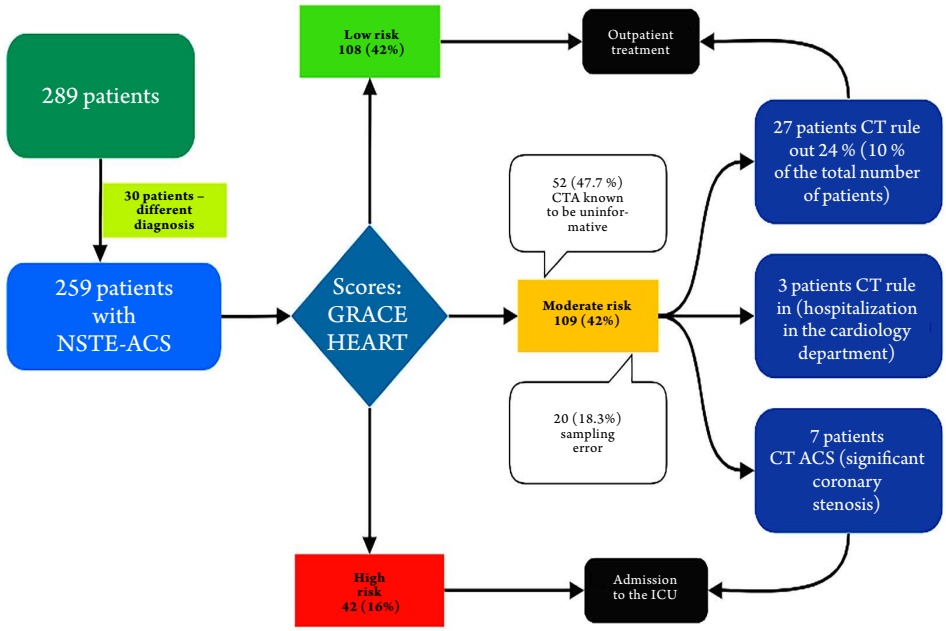
To further evaluate the effectiveness, we use the number of retained beds, calculated as the total number of patients × the mean number of days at diagnosis of ACS/investigation period in days.

All quantitative variables are presented as the mean ± standard deviation. The qualitative values are expressed as the absolute values and percentages.

Results

A total of 289 patients (59.5% male, mean age 71.7 ± 8.6 years) were admitted to the ED with a referral diagnosis of NSTE-ACS over the course of 69 days. The initial examination identified 30 patients with non-cardiac diseases requiring referral to other specialized departments. Among the 259 patients admitted with NSTE-ACS, 108 (42%) were classified as low-risk for AMI, 109 (42%) as low-to-medium-risk, and 42 (16%) as high-risk. Patients classified as high-risk were promptly referred for an invasive coronary angiography followed by percutaneous coronary intervention (PCI). In contrast, patients deemed low-risk were discharged from the hospital within two hours without undergoing additional radiation investigations. The CTA or the triple rule-out protocol was performed in 37 patients classified as medium-risk. Twenty-seven patients (24% of those classified as medium-risk and 10% of the total cohort) were found to be free of significant coronary artery stenosis, PE, and aortic dissection. These patients were discharged from the hospital

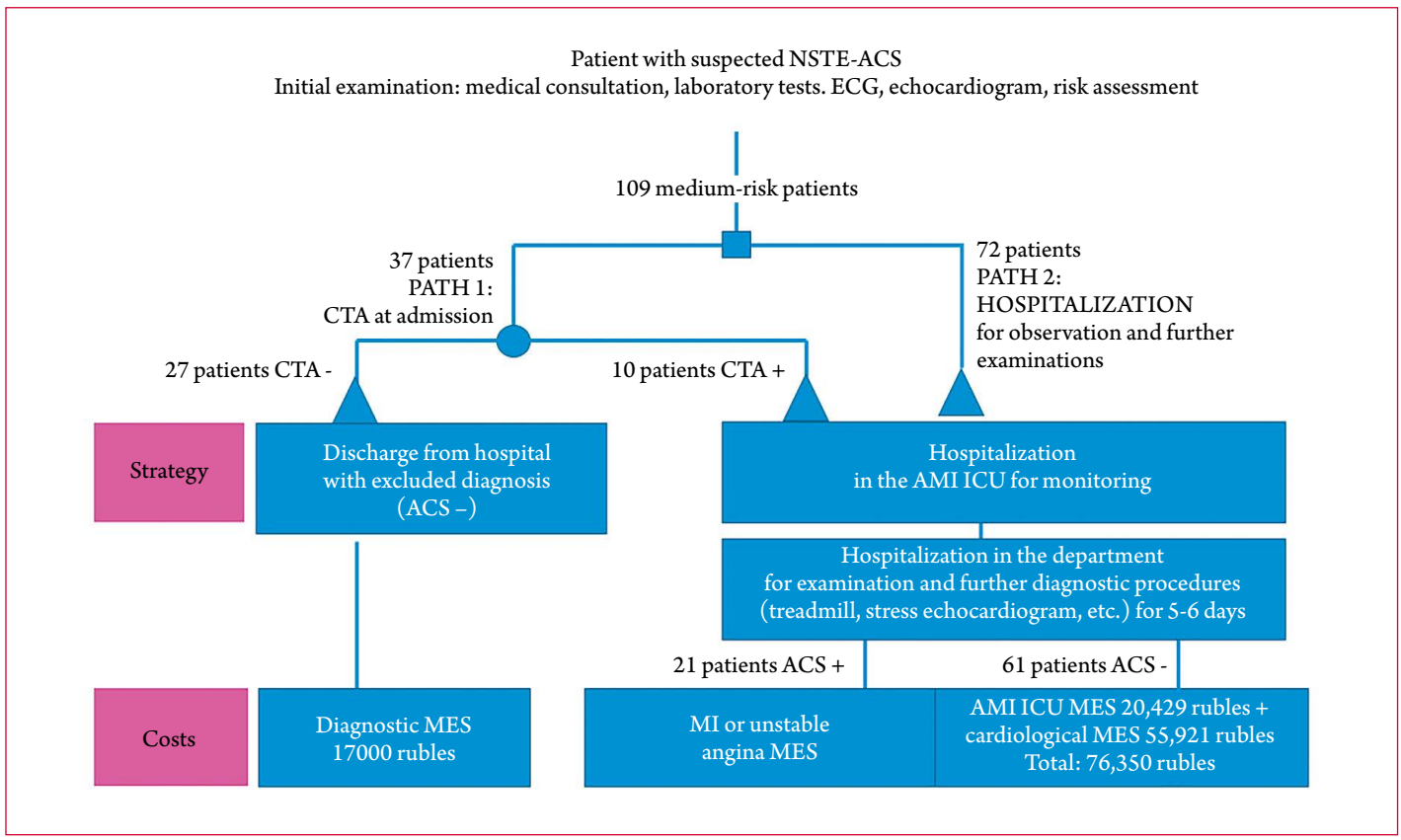
Figure 5. Distribution of all admitted patients with suspected NSTE-ACS according to risk



NSTE-ACS, non-ST-segment elevation acute coronary syndrome; CTA, computed tomographic angiography (CT coronary angiography and triple rule-out protocol); ICU, intensive care unit; CT ACS, significant stenosis of coronary arteries at CT coronary angiography.

within 2–4 hours, with diagnoses of coronary artery disease (CAD), PE, and AAS excluded. The CTA revealed significant arterial stenosis in seven patients, and two cases of PE and one case of aortic dissection were also identified. The patients were admitted to the AMI ICU or directly to the X-ray operating room, after which they were transferred to the cardiology department. A total of 72 medium-risk patients who did not undergo CTA met the exclusion criteria, including the presence of significant calcinosis, a history of stenting and CABG, or had known results of previous CTA or invasive coronary angiography, positive exercise tests. Additionally, some of these patients were diagnosed with other conditions requiring inpatient treatment, including de-

Figure 6. Decision tree for medium risk of NSTE-ACS specifying the number of patients included



Path 1: Admission and exclusion of significant coronary artery disease (CAD -), PE, and AAS – patient discharge; Path 2: Absence of CTA and possibility of CAD exclusion at admission, hospitalization in the AMI ICU, transfer to the cardiology department, and diagnosis revoked or confirmed within 5-6 days. NSTE-ACS, non-ST-segment elevation acute coronary syndrome; ACS, acute coronary syndrome; ECG, electrocardiogram; MES, medical and economic standard; MI, myocardial infarction; AMI ICU, acute myocardial infarction intensive care unit; CTA, computed tomographic angiography (CT coronary angiography and triple rule-out protocol).

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compensated CHF, paroxysmal AF, severe anemia, and others (please refer to Tables 2 and 3 in the supplementary materials available on the journal's website). The patients in this cohort were initially admitted to the AMI ICU and subsequently transferred to the cardiology department for further examination and treatment (Figures 5 and 6).

The mean time of CTA execution, taking into account patient preparation and positioning, was found to be 13 ± 1.3 minutes. The duration of the angiographic phase during CT coronary angiography was 1 second (one heartbeat) and 30.3 ± 0.7 seconds during the triple rule-out protocol. The mean time required for protocol formation by a radiologist, taking into account the necessity to perform vascular reconstructions of coronary arteries, pulmonary artery and its branches, aorta, and using an optimized short description protocol for the period of analysis, was 23 ± 8.3 minutes. The mean additional workload of a radiologist, as quantified by description time per day, was 5.6%. A total of 1.2% of the patients yielded false-positive results when compared with the data obtained from invasive coronary angiography procedures. The number of false-negative results was not analyzed. However, there were no readmissions of patients with no significant coronary artery stenosis to the ED with a diagnosis of ACS during the six-month follow-up period.

Among medium-risk patients admitted with NSTE-ACS, a confirmed diagnosis was established in 21 cases (19.3%), including 7 patients who underwent CTA at the time of admission and 14 hospitalized patients who did not undergo CTA. The economic costs related to the management of patients with unconfirmed NSTE-ACS are presented in Table 3 (please find in the supplementary materials provided on the journal's website).

It can thus be concluded that the economic benefit of utilizing CTA at the ED stage, employing the cost minimization analysis (CMA) for the analyzed period of 69 days, amounted to 1,602,450 rubles (6,718,800–5,116,350 = 1,602,450 rubles) for the specified period of the study, which is equivalent to 8,476,728 rubles per year as recalculated by the proportional method. The utilization of the CTA permitted the safe discharge of 27 patients diagnosed with NSTE-ACS from the ED, thereby releasing the bed fund of the specialized department (2.1 beds for the specified period). This enabled the provision of high-tech treatment for 27 patients with a mean hospitalization period of 5.5 days via paid medical services, high-tech medical care, and alternative funding channels.

Discussion

Contemporary radiologic diagnostic techniques, such as CTA, are integral to the evaluation of patients with cardiovascular disease, including chronic forms of CAD (ESC CCS), within the context of routine clinical practice.

In the 2023 European Society of Cardiology guidelines on ACS, a group of patients for whom CTA is advised at the initial examination, is identified. In other cases, the routine use of CTA is not recommended [9, 13].

The results of our study indicate that the implementation of CTA at the time of admission has the potential to reduce the proportion of unjustified hospitalizations by 10% of the total number of incoming patients and by 20% of patients at medium risk. This has the further benefit of reducing the cost of inpatient management while increasing the volume of specialized planned cardiac care and high-tech medical care without placing an additional burden on medical staff.

The CTA enabled the identification of significant coronary artery disease in 6.4% of medium-risk patients, allowing for the early performance of PCI and a potential reduction in the length of hospitalization. In accordance with the standard approach, an assessment of the coronary anatomy in these patients is conducted within a period of 72 hours following their hospitalization.

A comprehensive economic analysis demonstrated that the implementation of CTA and subsequent discharge of medium-risk patients results in a notable reduction in treatment costs. Upon recalculation of the results for the year, the cost savings for our center are estimated to be approximately 8.5 million rubles for 2023.

Furthermore, the savings in bed capacity allow for the hospitalization of patients requiring specialized planned cardiac care and high-tech diagnosis and treatment (approximately 143 patients per year) in vacated beds.

It is established that approximately 24% of patients at medium risk with non-excluded CAD are readmitted to the ED with a diagnosis of NSTE-ACS. The implementation of CTA during the initial hospitalization has the potential to reduce the incidence of rehospitalizations and associated treatment costs.

The clinical manifestations of AAS and PE are frequently nonspecific. The triple rule-out protocol facilitates the simultaneous exclusion of obstructive coronary artery disease, aortic dissection, and PE, thereby avoiding the potential risks associated with invasive coronary angiography in patients with aortic dissection. This method also ensures the safe discharge of the patient at the ED stage and transfer of the patient to the outpatient stage with a complete set of examinations. This reduces the diagnostic burden on the primary care service, allows for the prescription of primary preventive therapy, and mitigates the risk of cardiovascular accidents [14, 15]. The CTA assists in the stratification of risk in patients with NSTE-ACS, allowing for the avoidance of invasive coronary angiography in this patient group in the absence of life-threatening complications [11, 16].

The current Clinical Guidelines of the Ministry of Health of the Russian Federation on NSTE-ACS indicate that a CT diagnosis may be a reasonable means of excluding ACS

in patients with a low probability of CAD in the absence of ischemic changes on ECG and elevated blood levels of cTn I or T [17]. However, the timing of the investigation has not been specified, and the group of patients who will benefit most from this examination has not been identified. It is our hope that the updated guidelines, based on published data, including the presented study, will provide a clear definition of the role and place of CTA in the examination of patients with suspected NSTE-ACS.

Limitations

The study design is single-center with a relatively small number of patients included, which represents a significant limitation.

Rigorous inclusion criteria were employed in the study. The study design was limited to a sample of medium-risk patients for several reasons.

The utility of CTA in low-risk patients is uncertain. The implementation of a standard examination protocol enables clinicians to avoid hospitalization of patients with two negative troponin tests and no ECG changes without CTA.

In patients at medium risk, the safe and definitive exclusion of life-threatening pathology, particularly in cases with unusual clinical presentations, is of particular importance. The discharge of this cohort of patients from the ED based on ECG data and two negative troponin tests is associated with an elevated risk of complications.

One distinctive aspect of the care structure at our hospital is the presence of a RVC ED with a dedicated shock ward. This setting allows for the implementation of short algorithms and protocols for patient assessment, thereby obviating the need for the admission to the ICU and the implementation of CTA at the initial patient evaluation. Consequently, the findings of this study are most applicable to hospitals with a comparable model of care for ACS patients.

The technical equipment permits the performance of the CTA on patients exhibiting any cardiac rhythm and any heart rate. The personnel on duty have undergone training in the methodology of CTA and data evaluation.

Conclusions

The implementation of CTA and the triple rule-out protocol in medium-risk patients in the ED has the potential to significantly improve the process of excluding the diagnosis of NSTE-ACS. It can also optimize patient routing by reducing the number of unjustified hospitalizations in the MI ICU and cardiology department. Furthermore, it has the capacity to reduce the costs of treatment of patients in whom this diagnosis is not confirmed. This, in turn, can lead to an increase in the volume of specialized planned cardiology care and high-tech medical care without increasing the burden on medical personnel. This approach can be applied to at least 14% of patients admitted with a diagnosis of NSTE-ACS (at least 33% of medium-risk patients).

No conflict of interest is reported.

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