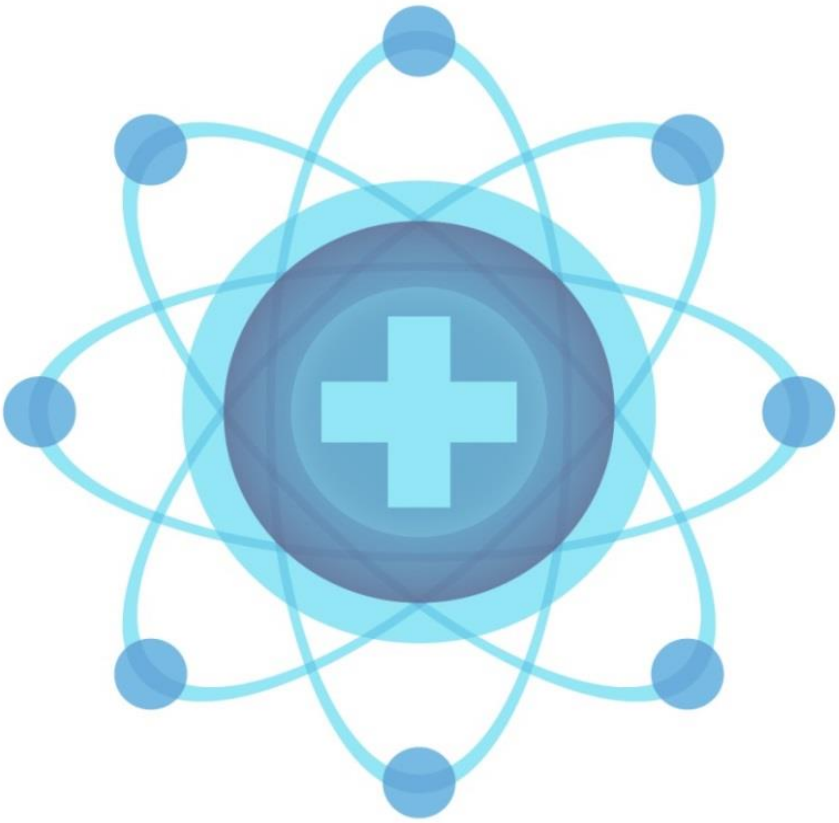

INTERNATIONAL MEDICAL SCIENTIFIC JOURNAL

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Available at https://www.bookwire.com/
ISBN: 978-0-578-26510-0

Improvement in Specialized Medical Care of Patients with Acute Coronary Syndrome in Tashkent City Running title: Acute Coronary Syndrome

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Abstract

The leading cause of death worldwide and in the Republic of Uzbekistan is cardiovascular disease, and its prevalence is increasing. To reduce morbidity and mortality from acute coronary syndrome, it is necessary to improve the high-tech specialized approach.. As part of the implementation of the Government Decree of December 18, 2020, No. 341, "On improving the organization of emergency care for patients with acute coronary syndrome in Tashkent" in order to provide the most effective care in terms of reducing mortality and disability for patients with coronary artery disease, significant investments have been made in the development of the cardiology service in Tashkent. The main strategic direction of this cardiology service is to provide the population with high-tech medical care in emergency cardiological conditions.

10.5281/zenodo.6552372

Keywords: Acute coronary syndrome, thrombolysis (ACS), percutaneous coronary intervention (PCI).

Introduction

Despite the progress made in the treatment of cardiovascular diseases (CVDs) in developed countries, acute coronary syndrome (ACS) continues to be the main cause of morbidity and mortality among patients of different age groups. The majority of cases are coronary heart disease (CHD), especially its acute forms, which require expensive treatment with the introduction of endovascular and surgical methods of treatment into everyday clinical practice [1-5].

Reperfusion therapy is the main component of the treatment of patients with ACS with ST segment elevation. Its use in the early stages significantly improves the immediate long-term prognosis of the patient [6-10]. Various types of reperfusion are used in clinical practice. The most affordable is thrombolytic therapy, and the preferred one is primary percutaneous coronary intervention performed at a high professional level [11-15].

Expanding the possibility of using various types of percutaneous coronary intervention is especially important for patients with an initially increased risk of death, which increases tenfold depending on the number of adverse signs [3, 16-19]. In this regard, a quantitative assessment of the risk of death can be used to select patients for a primary percutaneous coronary intervention [20-22].

Despite the absolute benefit of primary PCI in STEMI, economic, territorial, organizational, and social reasons prevent adherence to this standard in most European countries [7, 21, 24-26]. Moreover, until recently, there was no clear understanding of the availability of primary PCI and the results of its use in real life. To address these issues in 2008 in Europe, the project of the European Association of the "Percutaneous Cardiovascular Interventional Initiative", "Stent for Life", began its work. The goal of this initiative is to introduce national programs for the organization of PCI in ACS to reduce mortality [27, 28].

How is the generally recognized standard of adherence to primary PCI in patients with STEMI observed in Uzbekistan? Unfortunately, the lack of a functioning, full-fledged national registry for ACS in our country, associated with a number of objective difficulties, makes it extremely difficult to assess the availability of primary PCI for STEMI patients nationwide [29].

As part of the implementation of the Government Decree of December 18, 2020, No. 341 “On Improving the Organization of Emergency Medical Care for Patients with Acute Coronary Syndrome in Tashkent”, in order to provide the most effective care in terms of reducing mortality and disability for patients with coronary artery disease, significant investments have been made in the development of the cardiological service in Tashkent. The main strategic direction of this cardiological service is to provide the population with high-tech medical care in emergency cardiological conditions.

The aim of this paper is to improve care delivery and patient access to life-saving primary percutaneous coronary intervention, thereby reducing mortality and morbidity in patients with acute coronary syndrome (ACS).

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Material and research methods

By order No. 341 "On improving the organization of emergency medical care for patients with acute coronary syndrome in Tashkent", patients with a diagnosis of ACS and ST segment elevation should be provided the most effective emergency medical care as follows:

Emergency medical care should be provided to patients with acute coronary syndrome with ST elevation in Tashkent at the Republican Research Centre for Emergency Medicine 24 hours a day,, and primary PCI should be provided to patients at the Republican Specialized Scientific and Practical Medical Centre for Cardiology and the Republican Specialized Scientific and Practical Medical Centre for Surgery from 9.00 (the start of service posts function) until 17.00.

A list of districts that are part of the Republican Research Centre of Emergency Medicine (RRCEM), Republican Specialized Scientific and Practical Medical Centre for Surgery (RSSPMCS), and Republican Specialized Scientific and Practical Medical Centre for Cardiology (RSSPMCC) is shown in Table 1.

Table 1 Names of specialized scientific and practical centres and districts of the city of Tashkent in which they are located

№	Region	Names of the specialized scientific and practical centres	Name of the annexed districts
1.	Tashkent city	Republican Research Centre of Emergency Medicine (RRCEM)	Shaykhontohur Yakkasaray Sergeli Mirobod Yashnobod
		Republican Specialized Scientific and Practical Medical Centre for Surgery (RSSPMCS)	Uchtepa Olmazar Chilanzar
		Republican Specialized Scientific and Practical Medical Centre for Cardiology (RSSPMCC)	Yunusabad Mirzo-Ulugbek Bektemir

Our study was conducted at the RRCEM. This medical organization provides specialized cardiological and X-ray endovascular medical care to patients with acute coronary pathology around the clock (7 days for 24 hours).

To assess the immediate results of the treatment of ACS and AMI, a retrospective analysis of the annual statistical reports of the Department of Emergency Cardiology and Angiography of the RRCEM for 2019-2021 was carried out.

Research results

From 2019 to 2021, the number of people diagnosed with ACS increased by 62.3%. In 2019, 1888 cases of ACS were registered at the RRCEM. Of these, ACS with ST segment elevation (ACS↑ST) accounted for 51.4% (972), and the percentage of patients with ACS without ST elevation (ACSwST) was 48.6% (916). Among the outcomes of ACS↑ST, MI with Q developed in 50.4% (950) of patients, and MI without Q developed in 14.6% (276) of patients. Unstable angina (UA) developed in 31.1% (588) of patients, and other diseases were observed in 3.9% (74).

In 2020, 1050 cases of ACS were registered at the RSECMA. Due to the pandemic, the overall patient population has decreased. Of these, ACS with ST segment elevation (ACS↑ST) accounted for 66.2% (696), and the percentage of patients with ACS without ST elevation (ACSwST) was 33.8% (354). Among the outcomes of ACS↑ST, MI with Q developed in 58.2% (611) of patients, and MI without Q developed in 12.4% (131) of patients. Unstable angina (UA) occurred in 15.9% (285) of patients, and other diseases occurred in 2.2% (23).

In 2021, 2074 cases of ACS were registered at the RSECMA. Of these, ACS with ST segment elevation (ACS↑ST) accounted for 65.2% (1352), and the percentage of patients with ACS without ST elevation (ACSwST) was 34.8% (722). Among the outcomes of ACS↑ST, MI with Q developed in 53.1% (1100) of patients, and MI without Q developed in 11.8% (245) of patients. Unstable angina (UA) occurred in 30.2% (626) of patients, and other diseases occurred in 4.9% (103) (Fig. 1).

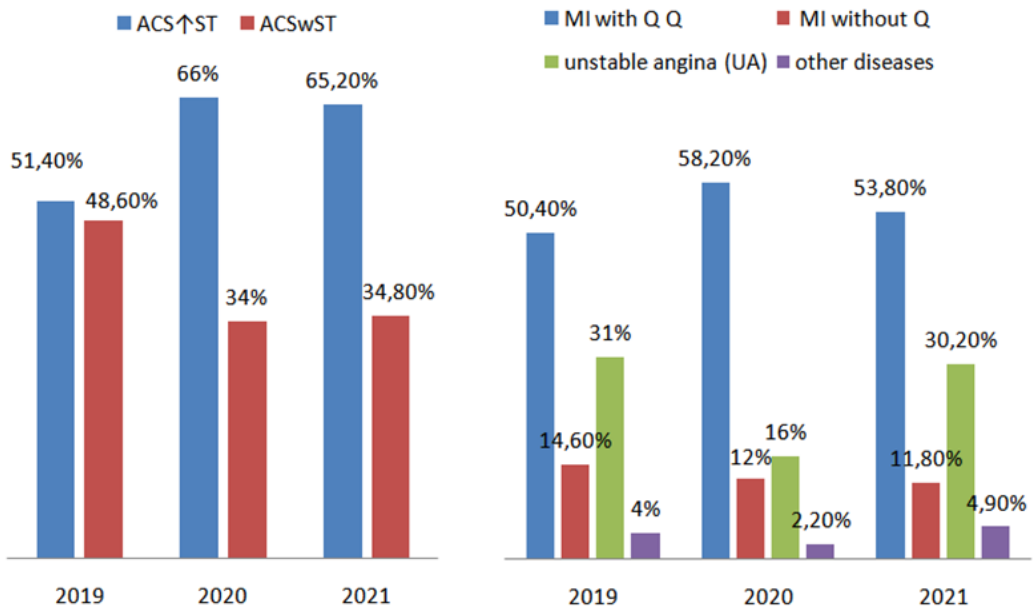

Fig. 1 Frequency of occurrence in ACS

In 2021, the largest number of coronary angiographies (CAG) was performed at RRCEM for the entire period of work in this area, 1356. Relative to 2019, during which 414 examinations, this represents a significant increase of 30.3 times. In 2019, emergency percutaneous coronary interventions in patients with ACS and AMI were performed at the RRCEM in isolated cases. Until 2020, only the residents of 2

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districts (Chilanzar and Sergeli districts) with ACS applied to the RRCEM, where emergency PCI was performed only until 14:00 on a working day. Other residents of Tashkent with a diagnosis of ACS applied to other medical institutions. Until 2020, the only reperfusion treatment used was thrombolytic therapy.

In 2019, 218 urgent percutaneous coronary interventions were performed; by 2021, this figure had increased by 89.3 times, amounting to 1100 operations. The proportion of patients with AMI who underwent coronary angiography and percutaneous coronary intervention (PCI) is presented in Table 2.

Table 2 Number of patients with AMI who underwent coronary angiography and percutaneous coronary interventions over 3 years

Year	CAG	PCI
2019	414	950
2020	917	611
2021	1356	1100

In 2019, 57.7% of patients with ACS↑ST and 77.7% of all patients with ACS were taken to hospitals by an emergency medical team within the first 6 hours of illness onset.

By order № 341 of 2021, all patients with ACS must be delivered to hospitals by ambulance teams. Thus, in 2021, 89.9% of patients with ACS and 91.5% of ACS↑ST patients were delivered by ambulance teams.

Given the widespread use of reperfusion therapy methods for myocardial infarction with ST segment elevation, the choice of optimal treatment tactics requires an objective assessment of the severity of the patient's condition, starting from the prehospital stage. Taking into account the timing of anginal status and the available opportunities, preference is given to the use of pharmacological or mechanical reperfusion, the use of certain drugs, and measures to reduce the delay at all stages until complete reperfusion is achieved.

Studies evaluating the effectiveness of thrombolytic therapy have found significant differences in mortality depending on a number of factors. It has been established that in patients under the age of 45 years, mortality during the first 30 days is 2.1%, from 45 to 55 years – 3.4%, and from 65 to 75 years – 24.3%. The risk factors for the occurrence of ACS are presented in Table 3.

Table 3 Risk factors for ACS

Risk factors for patients with ACS	Number of patients (n) %		
	2019	2020	2021
Arterial hypertension (AH)	947 (50.1%)	784 (74.6%)	1850 (89.2%)
Diabetes	568 (30.1%)	621 (59.1%)	1063 (51.2%)
Smoking	956 (50.6%)	841 (80.1%)	1926 (92.8%)

Dyslipidaemia	421 (22.3%)	482 (45.9%)	768 (37.3%)
Cases of sudden death in the family	123 (6.5%)	95 (9%)	157 (7.5%)

The frequency of previous cardiac history in patients with ACS is presented in Table 4.

Table 4 Frequency of prior cardiac history in patients with ACS

Previous cardiac history in patients with ACS	**Number of patients (n) %**		
	2019	**2020**	**2021**
Suffered a myocardial infarction (MI)	950 (50.3%)	611 (58.2%)	1100 (53.1%)
History of stable angina pectoris (SEA)	1088 (5%)	521 (49.6%)	2001 (96.4%)
Unstable angina (UA)	738 (39%)	239 (22.7%)	874 (42.1%)
Hypertension (HT)	947 (5%)	784 (74.6%)	1850 (89.2%)
Chronic heart failure (CHF)	30 (1.5%)	32 (30.4%)	54 (2.6%)
Coronary artery bypass grafting (CABG) performed	5 (0.3%)	7 (0.6%)	8 (0.38%)
Oncological diseases	2 (0.28%)	4 (0.38%)	8 (0.38%)
Diseases of the gastrointestinal tract	30 (1.6%)	36 (3.4%)	47 (2.23%)

The unfavourable prognostic significance of these and a number of other factors allows formation of an objective idea of the severity of the patient's condition, while an external examination, especially after pain relief, may be less informative. In this regard, several methods for quantitative risk assessment have been proposed. The simplest is the method developed by the TIMI group. It identifies eight independent predictors of death, allowing stratification of patients with a probability of death from 0.8% to 35.9% (Table 5).

Table 5 Independent Predictors of Death in TIMI Risk Quantification Scores

No.	**Predictors**	**Points**
1.	Age:	
	Over 75 years old	3
	Over 65 years old	2

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2.	IHD/AH/DM history	1
3.	↑ ST V2-6/acute LBBB	1
4.	DOS II-IV degree according to Killip	2
5.	HR>100 beats per minute	2
6.	Systolic BP<100 mmHg	3
7.	Weight<67 kg	1
8.	No reperfusion therapy in the first 4 hours	1

Based on the number of points reflecting their significance, the predictors can be divided into 3 groups: low, medium and high risk.

It is generally accepted that percutaneous coronary interventions are the preferred method of reperfusion therapy. However, even in RRCEM with the possibility of their 24-hour use, late admission to the hospital is the reason for refusal of reperfusion therapy. According to our data, in 2019, 950 visits with a diagnosis of myocardial infarction with ST segment elevation were registered at the RSECMA; only 45% of these patients were admitted within the first 12 hours, and reperfusion therapy was performed in 60%.

In 2020, out of 611 patients diagnosed with myocardial infarction with ST segment elevation, 45% were admitted within the first 12 hours, and reperfusion therapy was performed in 60%. In 2021, out of 1100 patients, 70% diagnosed with myocardial infarction with ST segment elevation were admitted within the first 12 hours, and reperfusion therapy was performed in 90%.

For revascularization in patients with ST elevation MI, the severity of the patient's condition should be determined in the first 24 hours from the onset of the disease. The emergency physician should be able to determine the severity of the patient's condition to solve the problem of transporting the patient to the RRCEM hospital.

List of indications for transporting patients with ACS to a hospital with the possibility of PCI:

1) Pin syndrome and ST segment elevation on ECG or ACS↑ST or newly diagnosed blockade of the left bundle branch block if TLT is contraindicated or impossible for ensuring delivery of the patient to the hospital in the first 12 hours from the onset of the pain syndrome;

2) ACS↑ST if the performed TLT is ineffective for ensuring delivery of the patient to a hospital with the possibility of PCI;

3) ACSwST with a recurrent nature of anginal pain in the presence of ST segment depression > 2 mm in more than two adjacent leads or a positive troponin test;

4) ACS complicated by life-threatening arrhythmias and conduction disorders.

Contraindications for transporting patients with ACS to a hospital with the possibility of PCI:

1) decompensated somatic pathology (renal and liver failure, acute pancreatitis, haemorrhagic diseases, severe anaemia, ulcerative lesions of the gastrointestinal tract in the acute stage, signs of ongoing bleeding, stage IV chronic heart failure);

2) Oncological diseases in the stage of metastasis (III-IV stage, documented);

3) Active forms of tuberculosis;

4) Acute infectious processes;

5) Mental illness with a personality defect;

6) Dementia;

7) Coma of unknown origin;

8) Refusal of treatment (PCI).

Over the 3 years, 1183 (895 males, 288 females) patients with acute myocardial infarction with ST-segment elevation out of 2661 patients underwent PCI. Of these, 425 patients (36%) had primary anterior MI, 354 (30%) had primary lower MI, 94 (8%) had involvement of circular infarction, and 310 (26%) had recurrent MI. In all cases, a quantitative assessment of the risk of death according to TIMI was carried out. In 54% of cases, the risk was high, in 18% - medium, and in 28% - low. Most patients with primary anterior infarction, involvement of circular MI, and recurrent myocardial infarction had a high baseline risk of death, while patients with primary inferior infarction had a low baseline risk (Fig. 2).

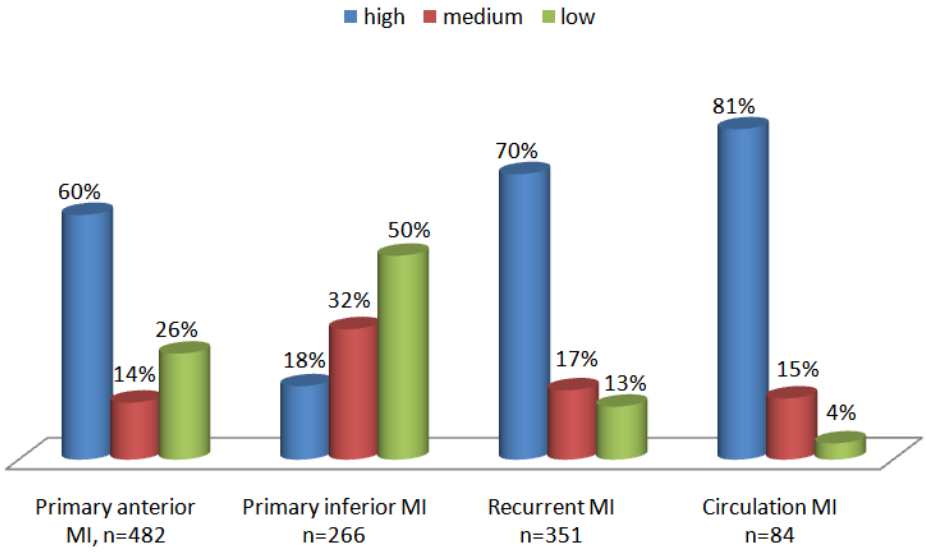

Fig. 2. Distribution of patients with different locations of MI divided by risk group according to TIMI

The distribution of patients with ACS with ST segment elevation by type of treatment is presented in Table 6.

Table 6 Distribution of patients with ST-segment elevation ACS by type of treatment

	Total number of patients (n)	**With PCI (n)%**	**Without PCI (n)%**
2019	1888	950 (50.3%)	938 (49.7%)
2020	1050	611 (58.2%)	439 (41.8%)
2021	2074	1100 (53%)	974 (47%)

Percutaneous coronary interventions (PCIs) in the first 12 hours were performed regardless of the risk of death. In the first 12 hours, they accounted for only 5.1±5.53% of all primary interventions (Fig. 3).

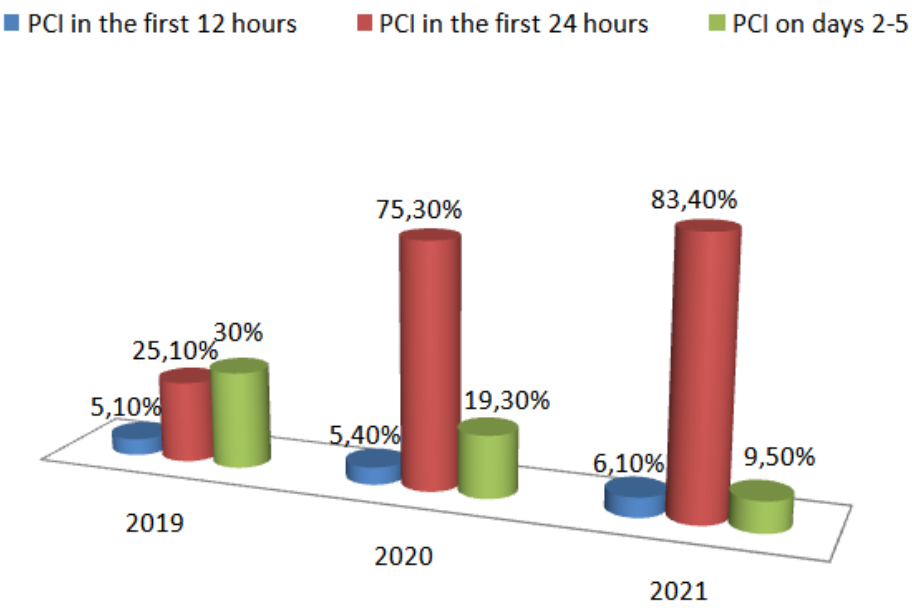

Fig. 3. Primary PCI according to the timing of the implementation in the acute period of MI

Over the three 3 years, percutaneous coronary interventions in the form of balloon angioplasty and stenting of the infarct-associated artery were performed for 1076 and 1574 patients, respectively. Regardless of the timing of the use of the primary percutaneous coronary intervention, stenting was performed for all patients (Fig. 4).

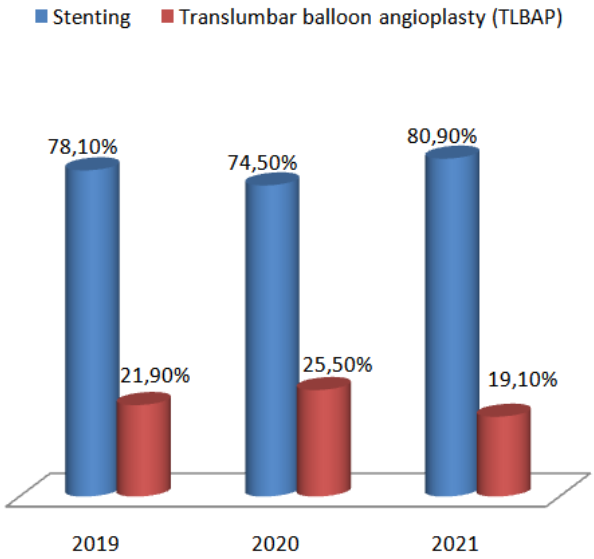

Fig. 4 Primary PCI according to the strategy of their application

At the RSECMA, mortality from AMI in 2019-2020, when coronary interventions were not used in the treatment of ACS with ST elevation, was unchanged (approximately 11%). The three-year mortality from 2019 to 2021 among patients with AMI at the RRCEM decreased to 8.9% (2019 -11%, 2020 -9.9%, 2021 - 8.9%) (Fig. 5).

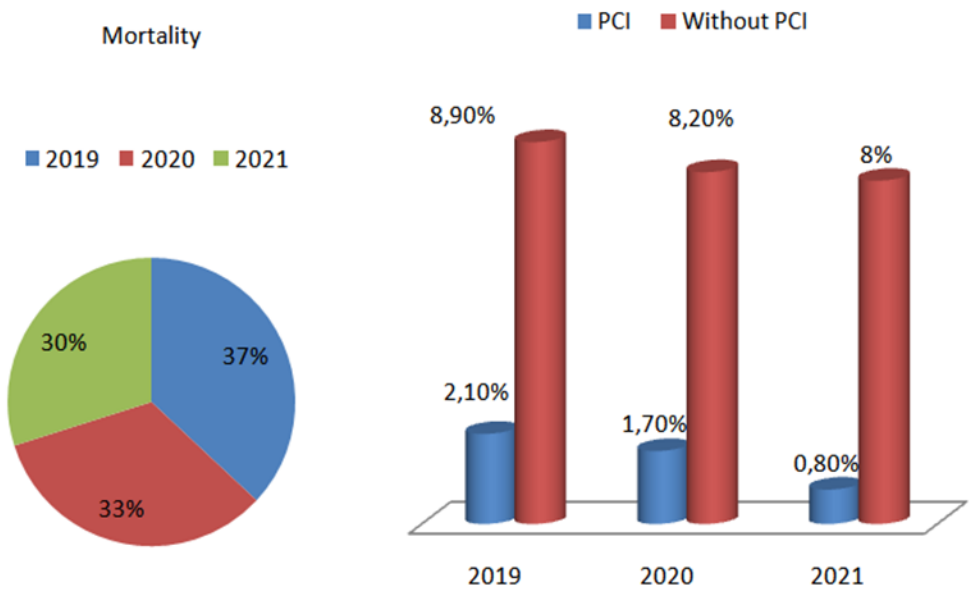

Fig. 5. Hospital mortality rate in patients with ACS (A), Hospital mortality according to the treatment strategy for ACS (B)

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Discussion of the results

The data obtained show that the number of patients with ACS↑ST was 1.5 times higher than the number of patients with ACSwST. More than 82% of patients had high blood pressure, one in three had angina pectoris, and more than half had an acute cardiovascular event (IM, UA).

The presented data emphasize the importance of using primary percutaneous coronary interventions as early as possible. Among the patients who died, 59% died from 12 to 24 hours from the moment of admission, while the rest (41%) died after 3 days at the earliest. In the absence of differences in the initial risk of death, mortality among patients without reperfusion therapy was 5 times higher than in patients with primary PCI.

As a basis for selecting patients for primary percutaneous coronary interventions, we selected those with an increased risk of death, determined by the TIMI scale, and stratified patients with a probability of death ranging from 0.8 to 24.6%. Given the high mortality among patients with anterior infarction, right ventricular involvement, and recurrent infarction, we considered it appropriate to use primary PCI in cases where the initial risk of death according to TIMI was not increased.

Our data indicate that primary percutaneous coronary interventions performed in the acute period of myocardial infarction can significantly reduce the incidence of complications and significantly increase survival. The indications for their use may be based on an increased risk of death according to TIMI.

Thus, regarding the optimal method for performing reperfusion therapy for STEMI, a clear understanding of the unconditional advantage of primary PCI was achieved, and recommendations were developed with absolute indications for this reperfusion strategy for STEMI. Nevertheless, work in this direction is just beginning in our country, and in this regard, the experience of foreign colleagues should be taken as the most important guideline.

Conclusions

1. Analysis of the effectiveness of an invasive strategy for the treatment of patients with ACS shows that PCI is a promising direction for preventing mortality and reducing morbidity and disability from coronary artery disease.

2. To improve the results of PCI for ACS, it is necessary to minimize the time from the patient's presentation to the provision of specialized care in hospitals with an angiocardiography department operating 7 days a week, 24 hours a day.

3. Increasing public awareness about acute heart attack and the availability of high-tech methods of treatment in order to timely seek medical help is important.

4. The work of the ambulance system and hospitals should be organized according to a single algorithm based on common principles for the diagnosis and treatment of ACS and a common understanding of tactical issues.

5. Ongoing staff training should be conducted at all stages of care for patients with ACS.

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