Clinical Management to Improve of Medical Care for Patients with Cardiovascular Diseases

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Objective: To improve clinical management of medical care to the patients with cardiovascular diseases (CVD).

Design: A Retrospective Observational Study.

**Setting: Scientific Clinical Center of Russian Railways Company,
Peoples' Friendship University of Russia (RUDN) University, Moscow, Russia.**

Method: The study was conducted from 1 October 2015 – to 30 September 2019. Object of study – Five hundred sixteen **patients with coronary artery disease and atherosclerosis of arteries of various localization were included in the study. The medical care algorithm consisted of endovascular and hybrid surgical treatment of common atherosclerosis of the arteries and long-term follow-up dynamic multidisciplinary monitoring of patients.**

Results: Improve clinical management has resulted in more effective results: The restoration of blood flow in coronary, subclavian, iliac, femoral or tibial arteries, performed during 14 days, was successful in all patients; the incidence of postoperative complications was 0.1%. There were no deaths. During the 1st year of follow-up, 37 (6 7%) patients performed repeated endovascular revascularization due to the development of restenosis of the stented segment of the following: coronary arteries 4 (0.8%), subclavian artery 2 (0.4%) and superficial femoral artery 31 (6%). Cardiovascular end points within 3 years of follow-up have not been achieved. Survival after 36 months was 100%.

Conclusion: Improving the clinical management of medical care for patients with CVD, of permanent medical care by cardiovascular surgeons of the vascular surgery department within the framework of one medical organization ensures high continuity of medical care, increases the survival of patients, and ensures high quality of public health.

INTRODUCTION

Improving the provision of medical care for patients with advanced atherosclerosis of the arteries, exacerbating the course of cardiovascular and other diseases, is an actual public health issue. Atherosclerosis is the basis for the development of acute myocardial infarction, stroke and gangrene of the extremities, which are the main causes of high mortality and disability in most people around the world. The share of vascular diseases among all causes of death from diseases of the circulatory system in the Russian Federation in 2016 was 4%[1,2]. Closing the vessel lumen with atherosclerotic plaque by 70% or more is considered hemodynamically significant narrowing, in which the risk of ischemic cardiovascular complications is high, which is an indication for surgical correction of blood flow[3,4,5]. With an increase in the age of the population, atherosclerosis progresses and affects the arteries supplying all vital organs and tissues − the heart, kidneys, brain, intestine and extremities, leading to acute or chronic ischemia and impaired function. Most elderly patients have concomitant diseases. In such cases, to determine the treatment strategy, a multidisciplinary team of specialists include a cardiovascular surgeon, neurologist, endocrinologist, cardiologist, nephrologist, etc[6].

Endovascular care is justifiably a priority in the treatment of cardiovascular diseases and occupies an important place in the high-tech and most effective minimally invasive medical care[4,5].

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The results of surgical treatment of patients with heart and vascular diseases depend on the qualifications of cardiovascular surgeons and their skills in vascular and endovascular surgery[7].

The main objectives of cardiovascular surgeons are the prevention of death from aortic aneurysm and its rupture, the prevention of acute cerebrovascular accident by eliminating stenosis of the carotid arteries, the prevention of amputation of limbs due to gangrene, the relief of symptoms and the treatment of trophic complications of chronic lower limb ischemia and venous insufficiency, modification of risk factors and improving the quality of life of patients with cardiovascular diseases, treatment of hemorrhagic and thrombotic complications of vascular surgery and vascular access for program hemodialysis. The treatment of surgical complications in the practice of interventional radiologists is performed by a cardiovascular surgeon[5,8].

According to the Russian recommendations for the organization of care for patients with peripheral arterial diseases, outpatient management of patients with asymptomatic atherosclerosis of the peripheral arteries or with intermittent claudication, including after successful surgical revascularization of the lower extremities, should be carried out by a cardiologist or general practitioner who are developing programs for correction of risk factors, drug therapy, monitoring the dynamics of the state of the circulatory system, as well as interaction with a cardiovascular surgeon (class of evidence IIA, level of evidence C)[9].

In One of the study showed that in order to increase the effectiveness of medical care for patients with surgical vascular diseases, it is necessary to introduce an appropriate statistical indicator, identify risk groups and their instrumental examination during medical examination of the population, expand the list of high-tech medical care and develop uniform standards for the equipment of vascular for organizations of all levels centers with the minimum necessary set of consumables and uniform equipment requirements and qualification of the specialists in cardiovascular centers[10].

Cardiovascular mortality is preventable with timely medical care. In the another study of the effectiveness of outpatient care, it was concluded that the observed decrease in mortality of people of working age in 2015 – 2017 it is connected with the improvement of the economic situation in the country, rather than with the improvement of the activities of medical organizations[11].

The aim of this study is to improve the clinical management measures of medical care to patients with cardiovascular diseases and evaluate their effectiveness.

METHOD

The research was performed in Department of cardiovascular surgery of the Scientific Clinical Center of Russian Railways Company from October 2015 to September 2019. Object of study Five hundred sixteen patients with coronary heart disease with angina pectoris 3 functional class, with concomitant atherosclerosis of brachiocephalic and lower extremities arteries, requiring planned surgical treatment were included in the study. All patients had not previously received surgical treatment and underwent conservative treatment[12-15].

The volume of observations of the sample was calculated by the formula[16]:

$$\mathbf{n} = \frac{t^2 \times p \times q}{\Delta^2},$$

t – Student's criterion, p - incidence rate from published data, q - 100-p%,

Δ ***- marginal error***

The minimum sample size in this study was:

$$\frac{4 \times 4 \times 96}{3 \times 3} = \mathbf{170\ people}$$

The average age of patients was 69.4±5.7 years. The algorithm of medical care for patients consisted of endovascular and hybrid surgical treatment of common arteriosclerosis and long-term clinical dynamic multidisciplinary observation of patients.

The diagnosis of coronary heart disease in patients with stable angina was confirmed using stress echocardiography on an outpatient basis, after which they underwent a polyclinic examination before hospitalization for coronary angiography and PCI. A mandatory examination plan for all patients included echocardiography, holter ECG monitoring, 2-times per every day monitoring of blood pressure and pulse rate; duplex scanning of brachiocephalic arteries, abdominal aorta, arteries and veins of the lower extremities; gastroscopy; in blood tests examined the level of glycated hemoglobin, lipid profile and indicators of nitrogen metabolism. In Table 1 shows the characteristics of patients included in the study.

Table 1: Characteristics of the Patients

Indicators	Size
Average age	69,4±5,7 лет
Number of women in study	42(8,1%)
Arterial hypertension	516 (100%)
Type II diabetes	88 (17%)
A history of smoking	39175,8%)
A history of myocardial infarction	201 (38,9 %)
Erosive gastritis/gastric ulcer (duodenal ulcer)	29/25
Chronic renal failure	98(6,6 %)
Programmed hemodialysis	7 (1,3%)
Critical chronic lower limb ischemia 4 st.	122 (23,6%)
Critical chronic lower limb ischemia 3 st.	284 (55%)
Stenosis of the internal carotid artery more than 70%	54 (10,5%)
Occlusion of the subclavian artery	6 (1,16%)

Erosive gastritis and peptic ulcer of the stomach and duodenum was detected in 54 (%) patients; this were a contraindication for surgical treatment until healing, which was established during control gastroscopy after antiulcer therapy. More than 70% asymptomatic stenosis of the internal carotid artery was revealed in 54 (10.5%) patients with ultrasound dopplerography, asymptomatic occlusion of the left subclavian artery in 6 (1.16%), and in 406 (78.7%) – occlusive/subocclusive lesion of the lower extremities arteries with chronic ischemia 3 - 4 st. (according with classification to Fontaine-Pokrovsky). A percutaneous coronary intervention in patients with coronary heart disease was performed by a cardiovascular surgeon who had been trained in endovascular technology and had more than 5 years of experience.

After PCI for coronary heart disease, patients who showed atherosclerotic hemodynamically significant damage to arteries of other locations and had indications for surgical correction, performed endovascular or hybrid operations sequentially on the internal carotid artery, subclavian and lower extremities arteries in the next 14 days. Hybrid operations on the lower extremities arteries included the surgical and endovascular steps. The surgical step consisted of endarterectomy

from the common femoral artery with occlusion and stenosis of more than 70%. The choice of endovascular or hybrid treatment strategy was carried out by the cardiovascular team, including a cardiovascular surgeon, cardiologist and anesthetist based on current recommendations and stratification of surgical and anesthetic risks of complications.

All endovascular procedures were performed on the local infiltrative anesthesia. Hybrid revascularizations on the lower extremities were performed with epidural anesthesia.

The multiplicity of follow-up by a cardiovascular surgeon and a cardiologist after surgical treatment was 1, 3, 6, 9, 12 and subsequent every 6 months. Patients with impaired carbohydrate metabolism were dynamically observed by an endocrinologist. Patients with impaired renal function were dynamically observed by a nephrologist. The control gastroscopy at the outpatient stage was performed once every 6 months.

The results were studied in terms of the effectiveness and safety of surgical treatment, assessing the quality of a multidisciplinary approach at the stage of diagnosis to determine the optimal and safe sequence of revascularization, the timeliness of medical care, including the development of complications, survival of patients and the development of endpoints of cardiovascular events (acute myocardial infarction, stroke, bleeding and big amputation of low extremities, death) in patients at the hospital stage and within 36 months after surgical treatment.

In results of study were formulated of suggestions for improve the provision of medical care to patients with cardiovascular diseases.

RESULT

Endovascular treatment of patients with coronary heart disease was successful in all cases, 516 (100%), which was confirmed by control stress echocardiography 1 and 3 months after PCI. The terms of hospital treatment of patients after PCI was 3 days. One % patient in the early postoperative period after PCI developed bleeding from the site of puncture and catheterization of the common femoral artery with the formation of a pulsating hematoma. The complication was eliminated by suturing the puncture opening with a hemostasis system. Indications for choosing an endovascular treatment strategy for complications were established by a cardiovascular surgeon, who also performed the procedure of repeated hemostasis. There was no delay in the provision of medical care, which did not affect the length of hospitalization. The incidence of postoperative complications was 0.8%.

A detailed examination of patients with coronary heart disease made it possible to diagnose in patients a widespread obliterating atherosclerosis of the lower extremities arteries, internal carotid and subclavian arteries and perform stage surgical treatment. Hybrid and endovascular revascularization were successfully performed for all patients with atherosclerosis of the lower extremities arteries and critical limb ischemia, there were no complications. Patients with lesions of the brachiocephalic and carotids arteries underwent stenting number %. The terms of hospitalization of patients after stenting of peripheral arteries was 3 days, after hybrid revascularization of the lower extremities - 7 days. There were no complications.

A study of the safety of surgical treatment of common atherosclerosis of the arteries indicated the absence of the development of terminal cardiovascular points, such as myocardial infarction, cerebrovascular accident, bleeding and big amputations.

Dynamic monitoring of patients at the ambulatory stage after discharge from the hospital provided timely detection of restenosis of stented segments of the arteries, clinically manifested by the return of coronary heart disease and limbs. During the first year of follow-up, 32 (15 6.2%) patients were hospitalized again due to the development of restenosis of the stented segment of the: coronary arteries 4 (0.8%), subclavian artery 2 (0.4%) and superficial femoral artery 26 (5%). All patients underwent endovascular care – re-stenting or balloon angioplasty of the restenosis zone. There were no complications. Survival after 12, 24 and 36 months was 100%.

Correction of antihypertensive therapy during two years of follow-up was performed on 421 patients (81.6%). The main method of dynamic control with blood pressure and heart rate was a daily of morning and evening hemodynamic parameters.

All patients had low risk of developing hemorrhagic complications; therefore, patients continued antiplatelet therapy using clopidogrel 12 months after surgery after discontinuation of double antiplatelet therapy with acetylsalicylic acid and clopidogrel, patients continued antiplatelet therapy using clopidogrel.

It was established that restenosis of stented segments in the coronary and peripheral arteries develops during the first year after revascularization. Dynamic patients of follow-up with a cardiovascular revascularization for 3 years after surgery treatment made it possible to establish a diagnosis in a timely manner and safely perform a second operation using endovascular technology. Taking into account the data of scientific publications on the results of surgical treatment of patients with atherosclerosis of the lower limb arteries, in particular, the high incidence of femoral-popliteal shunts occlusion during the first two years after revascularization, the endovascular strategy for critical chronic lower limb ischemia can be considered a priority.

Improving the clinical management of medical care for patients with CVD, of specialized endovascular care at the expense of compulsory medical insurance contributed to the high availability of minimally invasive high-tech medical care for the population.

CLINICAL CASE

Patient was a 82-years-old, was hospitalized in the cardiovascular department with complaints of severe general weakness, unsteady gait, pain in the right lower limb at rest and worse at night, chilliness of both legs and feet, decreased sensitivity of the skin of the right lower leg and foot, shortness of breath and discomfort behind the sternum with little physical exertion, such as walking at a slow pace and taking off your clothes, increased blood pressure 200/110 mmHg, and sleep disturbance.

From the anamnesis of the disease, it was found that the above complaints related to ischemia of the heart and lower extremities began to be disturbed for the first time about 2 years ago with a gradual progressive worsening of the condition: a decrease in the distance of painless walking over the past month from 2 years from 500 m to 5-10 meters, the development of pain in the right foot at rest and at night and sleep disturbance. Increase in blood pressure up to 200/110 mmHg worries over the past 10 years, his antihypertensive drug therapy was not permanent, and he did not regularly measure blood pressure. Of the bad habits, Smoking has been noted over the past 60 years.

With objective and instrumental methods of examination, which was carried out within 4 hours, the following was revealed: the patient's condition is severe, the body position is forced with the lower limbs

down, facial dolorosa, signs of critical chronic ischemia of the right lower limb 3 st. according to Fontaine-Pokrovsky classification, the ankle-brachial index on the right was 0.37 and on the left was 0.60. Arterial hypertension and a significant difference in systolic blood pressure on the right and left shoulders of 150 mmHg: left 190/100 mm Hg, right - 40/0 mm Hg. Angina pectoris of functional class 3, according to ECG on a background of sinus tachycardia at rest up to 88 heart contractions per minute, disturbances in the myocardial blood supply of the anterior-septal and lateral segments of the left ventricle were revealed; according to echocardiography at rest was detected, hypokinesis of the basal and lateral segments of the left ventricle wall and ejection fraction 48%. according to stress echocardiography exacerbation of hypokinesis of the basal, posterolateral and middle segments at a heart rate of 108 beats per minute, at the complex scanning brachiocephalic arteries revealed subocclusion of right subclavian artery stenosis and up to 80% of the left internal carotid artery. at Gastroscopy showed signs of chronic atrophic gastritis. with Holter ECG monitoring, in blood and urine tests detected no pathological changes were not detected.

Clinical diagnosis: Common atherosclerosis was diagnosed. Atherosclerosis of the lower limb arteries, critical chronic arterial ischemia of the right lower limb 3 st. (according to the classification of Fontaine-Pokrovsky). Atherosclerosis of the brachiocephalic arteries, subocclusion of the right subclavian artery, stenosis of the left internal carotid artery 80%. Atherosclerosis of the coronary arteries. Ischemic heart disease, angina pectoris 3 FC, chronic heart failure 2 FC; arterial hypertension III st. risk of cardiovascular complications 4.

Conservative therapy was prescribed: a combination of perindopril arginine and indapamide 5 mg in the morning, beta-selective adrenoblocker 5 mg, loop diuretic 40 mg intravenously and acetylsalicylic acid 100 mg in the morning, clopidogrel 75 mg, atorvastatin 40 mg, omeprozole 20 mg and a selective calcium channel blocker of class II 5 mg in the evening. In order to treat pain in the lower extremities, a permanent epidural catheter was installed for the infusion of anesthetic. The medical consultation consisting of a cardiovascular surgeon, cardiologist and anesthesiologist determined the strategy of the surgical treatment - to perform angiography of the coronary, brachiocephalic and lower extremities arteries and intraoperatively determine the sequence and method of revascularization.

Figure 1 shows a picture of the lower extremities of patients, 82 years old before revascularization.

Figure 1: A picture of the Lower Extremities of patient S., 82 years old before Revascularization

Figure 1 shows that the skin of the right lower limb is cyanotic, marbling of the skin is noted.

After 12 hours of conservative treatment, the intensity of pain in the right foot decreased. The patient was able to sleep at night, swelling of the legs and feet decreased by half, blood pressure on the right shoulder 130/80 mm Hg, frequency heart rate of 68 beats per minute, angina attacks did not recur.

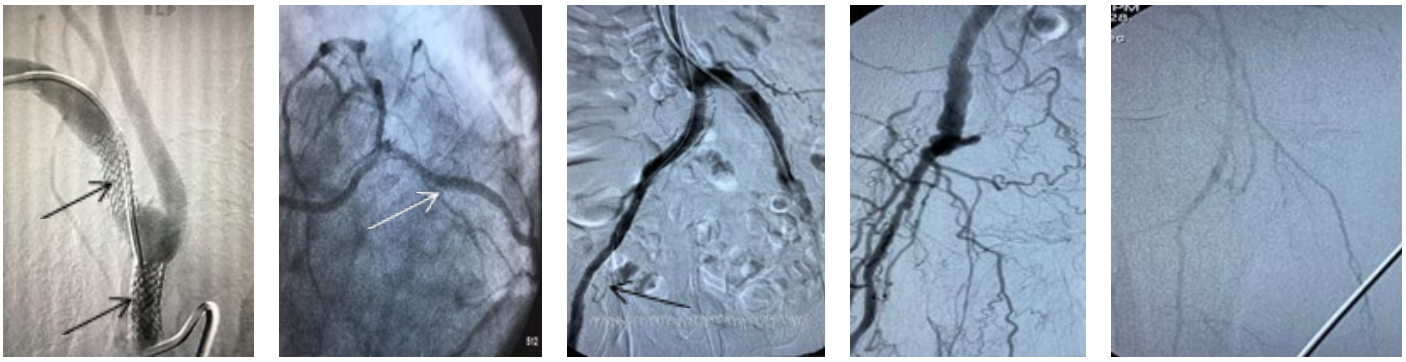
According to the strategy chosen by the cardiovascular team, a diagnostic angiography of the coronary, brachycephalic arteries, the abdominal aorta and lower limb arteries was performed. The results of the angiography are presented in figures 2a, 2b, 2c, 2d and 2e (A-E).

Subocclusion of the right subclavian artery and brachycephalic trunk, stenosis of the left internal carotid artery in the C1 segment 80% and C3 segment 90%, stenosis of the circumflex branch of the left coronary artery 90%, chronic occlusion of the right common and external iliac and common femoral arteries were diagnosed.

An intraoperative consilium was held. Considering the patient's serious condition and high risks of developing cardiovascular complications,

(A) **(B)** **(C)** **(D)** **(E)**

Figure 2 (A): Angiogram of the left coronary artery. The arrow indicates the stenosis of the circumflex branch of the left coronary artery
Figure 2 (B): Angiogram of the brachycephalic trunk. Arrows indicate the stenosis of brachycephalic trunk and right subclavian artery.
Figure 2 (C): Angiogram of the left common carotid artery. The arrow indicates the stenosis of the C1 segment of the left internal carotid artery.
Figure 2 (D): Angiogram of the left internal carotid artery. The arrow indicates the stenosis of the C3 segment of the left internal carotid artery.
Figure 2 (E): Angiogram of the infrarenal parch of the abdominal aorta and iliac arteries. The arrow indicates occlusion of the right iliac and common femoral arteries.



(A) **(B)** **(C)** **(D)** **(E)**

Figure 3 (A): Angiogram of the brachycephalic trunk. The arrow indicates the stented segments of the right subclavian artery and brachycephalic trunk.
Figure 3 (B): Angiogram of the left coronary artery. The arrow indicates the stented segment of the circumflex branch of the left coronary artery
Figure 3 (C): Angiogram of the lower extremities arteries. Arrows indicate the stented segment of the iliac and common femoral arteries. The right iliac and common femoral arteries are visualized.
Figure 3 (D): Angiogram of the arteries of the right lower limb. Contrasting the right common and deep femoral arteries.
Figure 3 (E): Angiogram of the right lower extremities arteries. Right popliteal and tibial arteries on collaterals from the system deep femoral artery are visualized.

it was decided the endovascular technology for revascularization and perform in first step are stenting of the circumflex branch of the left coronary artery, brachycephalic trunk, right subclavian artery and recanalization and stenting of the right iliac and common femoral arteries in one session. Figures 3A-E show the results of endovascular care.

Endovascular care was successful; there were no complications, during the revascularization of the right lower limb, recanalization of chronic occlusion of the right superficial femoral artery was not performed, the epidural catheter was removed 2 days after revascularization, the patient was discharged for 3 days with recommendations to stop smoking, control blood pressure and frequency pulse and continuous medication. At the stage of discharge from the hospital, the signs of critical ischemia of the right lower limb were stopped, the sensitivity of the skin was restored, the distance of painless walking increased to 200 meters, no dizziness or general weakness were not disturbing, blood pressure on the right and left shoulders were 130/80 mm Hg, frequency heart rate of 70 per minute. With Stress echocardiography –revealed normokinesis with a heart rate of more than 120 per minute.

On the Figure 4 shows a picture of the lower extremities of patients, 82 years old, on the 3rd day after endovascular revascularization, which shows that the skin of the right lower limb is of normal physiological color.

Figure 4: The Lower Extremities of patients, 82 years old, on the 3rd Day after Endovascular Revascularization.

After 7 days, the patient was hospitalized again for stenting of the left internal carotid artery in order to reduce the risk of stroke.

Figure 5 shows an angiogram of the left internal carotid artery after successful stenting of C1 and C3 segments. After surgery treatment, the patient was discharged on the 3rd day in a satisfactory condition. Control echocardiography 3 months after treatment showed the absence of hypokinesis of the basal and lateral segments, the ejection fraction of the left ventricle increased to 52%.

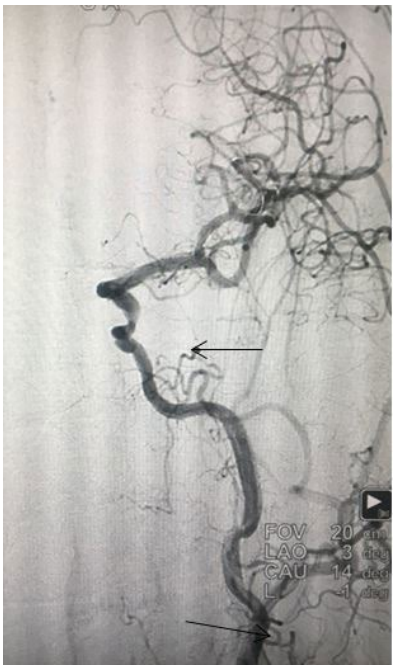


Figure 5: Angiogram of the Left Internal Carotid Artery after Stenting of C1 and C3 Segments. Arrows Indicate are Stented Segments.

During 3 years of dynamic follow-up according to the established scheme, the staged correction of antihypertensive therapy and the patient's complete cessation of smoking, no deterioration was observed, and progression of lower limb and myocardial ischemia was not observed. Dual antiplatelet therapy continued after 3 years.

DISCUSSION

The cardiovascular team, including a cardiologist, anesthesiologist and cardiovascular surgeon with the skills of vascular and endovascular surgery, ensured the high quality of medical care in patients with advanced atherosclerosis of the arteries, which was characterized by timely diagnosis of cardiovascular diseases, including hospital complications, and the timely conduct of safe and effective staged surgical treatment using a minimally invasive endovascular technology for a short time.

Dynamic clinical examination, identification of risk factors for cardiovascular diseases and a functional study of the blood supply to the heart and limbs, dopplerography of the brachiocephalic arteries and stress echocardiography, study of glycated hemoglobin, lipid profile and other laboratory parameters in patients with cardiovascular diseases on an ambulatory step provided timely detection of signs of progression of atherosclerosis of the arteries and side effects of surgical operations on the arteries.

Step-by-step monitoring by a curator (cardiovascular surgeon) of patients' recommendations on modifying risk factors for cardiovascular complications, drug therapy and hemodynamic parameters such as blood pressure and heart rate allowed for timely correction of appointments.

The use of minimally invasive endovascular technology ensured the effectiveness and safety of treatment when performing revascularization of the heart, lower extremities and stenting of the brachycephalic arteries with a low incidence of adverse outcomes. Endovascular care may justifiably be the technology of choice in determining the primary treatment strategy for cardiovascular diseases associated with atherosclerosis of the coronary, peripheral and brachiocephalic arteries.

CONCLUSION

Improving the clinical management of medical care for patients with CVD, of permanent medical care by cardiovascular surgeons of the vascular surgery department within the framework of one medical organization ensures high continuity of medical care, increases the survival of patients and ensures high quality of public health.

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Competing Interest: None.

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