

# The disability in hypertensive patients with coronary heart disease after coronary intervention with angioplasty and stenting

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## Abstract

**Background.** Cardiovascular diseases, in particular coronary heart disease (CHD) associated with hypertension, are an important medical and social problem. **Objective.** To study the effects of hypertension on primary disability in patients with CHD after percutaneous coronary intervention — coronary angioplasty and stenting. **Design and methods.** The study was conducted in the office of medical and social examination (St Petersburg). The main group consisted of 65 hypertensive (III grade) patients with CHD after coronary stenting. The comparison group included 49 patients with CHD without known hypertension. **Results.** There was a higher occurrence of left ventricular hypertrophy (LVH) (92,3 and 69,4 %,  $p < 0,01$ ), more severe impairment of LV systolic function (ejection fraction —  $56,3 \pm 1,1$  and  $48,1 \pm 1,0$  %,  $p < 0,001$ ), lower tolerance to physical load, more severe chronic heart failure in hypertensive patients with CHD compared to non-hypertensive subjects. Evaluation of clinical outcomes of coronary stenting showed higher re-occurrence rate of CHD symptoms in hypertensive patients than in the comparison group (27,7 and 12,2 % respectively,  $p < 0,05$ ). The rate of disability was higher in hypertensive patients with CHD compared to subjects with normal blood pressure. **Conclusion.** Hypertensive patients with CHD and high blood pressure have poorer outcomes of percutaneous coronary intervention procedures, higher rate of disability and require more rehabilitation procedures.

**Key words:** hypertension, coronary heart disease, coronary artery stenting.

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## Оценка показателей инвалидности у больных ишемической болезнью сердца в сочетании с артериальной гипертензией после проведения стентирования коронарных артерий

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## Резюме

**Актуальность.** Сердечно-сосудистые заболевания особенно сочетание ишемической болезни сердца (ИБС) и артериальной гипертензии (АГ), являются одной из важнейших медико-социальных проблем в современном мире. **Цель исследования** — изучение влияния АГ на показатели первичной инвалидности у больных ИБС после стентирования коронарных артерий. **Материалы и методы.** Исследование было проведено в бюро медико-социальной экспертизы Санкт-Петербурга. Основную группу составили 65 больных ИБС после проведения стентирования коронарных артерий, у которых была диагностирована гипертоническая болезнь (ГБ) III стадии. Группу сравнения составили 49 больных ИБС, у которых на момент исследования ГБ не была диагностирована. **Результаты.** У больных основной группы отмечены более высокая встречаемость гипертрофии левого желудочка (ЛЖ) (92,3 и 69,4 %,  $p < 0,01$ ), более выраженное нарушение систолической функции ЛЖ (фракция выброса —  $56,3 \pm 1,1$  и  $48,1 \pm 1,0$  %,  $p < 0,001$ ), более низкие показатели толерантности к физической нагрузке, более тяжелое течение хронической сердечной недостаточности, чем в группе сравнения. Оценка клинических исходов стентирования коронарных артерий показала более частое возобновление симптомов ИБС у больных основной группы, чем в группе сравнения (27,7 и 12,2 % соответственно). При анализе показателей первичной инвалидности отмечено, что больные группы сравнения значительно реже признавались нетрудоспособными (или с ограниченной трудоспособностью), чем пациенты основной группы. **Выводы.** У пациентов с сочетанием ИБС и ГБ III стадии с высокими показателями артериального давления результаты стентирования коронарных артерий хуже, а частота нетрудоспособности выше, по сравнению с лицами группы сравнения. Больным с сочетанием ИБС и ГБ III стадии также требуется проведение более широкого спектра реабилитационных мер.

**Ключевые слова:** артериальная гипертензия, ишемическая болезнь сердца, стентирование коронарных артерий.

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## Introduction

Nowadays, hypertension (HTN) is one of the most important medical and social problems with high prevalence in different countries [1–3]. Structural and functional changes of the microvasculature is an important component of HTN pathogenesis contribute to the formation and progression of organ damage, and may play role in the development of associated clinical diseases, such as coronary artery disease (CAD) [4, 5]. Violations at different levels of the circulatory system are probably interrelated and may either compensate or, conversely, exacerbate each other being of particular importance in the advanced HTN stages [5, 6]. At the same time the issues of disability, including permanent disability, and its causes are underexplored.

The purpose of our study was to assess the role of HTN in the occurrence of primary disability in

patients with CAD after coronary artery angioplasty and stenting.

## Design and methods

The study was conducted in the Centre of medical and social expert examination (of CMSEE) St Petersburg from September 2012 to May 2014. The main group included 65 patients with CAD and HTN III stage with achieved 1 degree of blood pressure elevation who underwent coronary artery angioplasty and stenting. Exclusion criterion for the main group was the presence of symptomatic HTN. The average age of patients from the main group was  $58.6 \pm 1.2$  years old. The comparison group included 49 patients with CAD after coronary artery angioplasty and stenting without HTN. Their average age was  $57.2 \pm 1.2$  years. All patients underwent primary (3–6 months

after coronary artery angioplasty and stenting) examination in the CMSEE.

Sixty-three 63 patients from the main group and 41 patients from the comparison group were re-examined: those with the first degree disability — in 2 years, those with 2nd and 3d degree disability — one year after the initial examination (those who were not considered disabled at primary examination did not undergo re-examination in the CMSEE). The indications for coronary angioplasty and stenting in both groups were myocardial infarction (MI) during the first 48 hours (78.5 and 73.5 %, respectively,  $p > 0.05$ ); unstable angina (13.8 and 10.2 %, respectively,  $p > 0.05$ ); high functional class (FC) exertional angina pectoris (7.7 and 16.3 %, respectively,  $p > 0.05$ ). Complete revascularization was performed in 75.4 % cases in the main group and in 83.7 % subjects in the control group ( $p > 0.05$ ). At the time of examination in the CMSEE the drug therapy in the main and control groups were as following:  $\beta$ -blockers were prescribed for 86.2 and 83.7 % patients, respectively ( $p > 0.05$ ); statins — for 86.2 and 85.7 %, respectively ( $p > 0.05$ ); angiotensin converting enzyme inhibitors — for 63.1 and 6.1 % ( $p < 0.001$ ); angiotensin receptor blockers — for 18.5 and 2.0 % ( $p < 0.01$ ); diuretics — for 16.9 and 10.2 % ( $p > 0.05$ ); calcium channel blockers — for 21.5 and 12.2 % ( $p > 0.05$ ); nitrates — for 15.3 and 4.1 % ( $p < 0.05$ ); antiplatelet therapy — for 95.4 and 95.9 %, respectively ( $p > 0.05$ ).

The conventional clinical, instrumental and laboratory parameters were assessed according to the standards for CAD and HTN diagnostics and management before examination at CMSEE [7]. Twelve-channel standard electrocardiography (ECG) was performed to determine the heart rate, cardiac conduction parameters, presence of ischemic changes, myocardial scarring, heart hypertrophy, systolic and diastolic overload, repolarization.

Echocardiography (ECHO) was carried out by «SonoAce 8000» (Medison, Korea) according to standard procedure. The following parameters were assessed: ejection fraction (EF) by Simpson method, end-systolic, end-diastolic size of heart chambers, akinetic and hypokinetic wall motions and myocardial wall thickness. EF reduction till

45–50 % was considered insignificant, 35–45 % — moderate, 25–35 % — severe, below 25 % — very severe.

All patients underwent bicycle ergometry (BEM) with the use of diagnostic system «CardioSoft» version 6.0 GE Medical Systems (Germany). Step-by-step with increased load technique was used. ECG and blood pressure (BP) were recorded for the report in the pretest on the 2nd minute of each stage, on the 1st, 3rd, 5th minute of the recovery period. The assessed parameters included the capacity of the physical load (W) and the amount of the applied load ( $\text{kg} \times \text{m}$ ). Ambulatory BP monitoring (ABPM) was performed by the «Tonoport IV» device (Hellege, Germany). We analyzed the mean values of systolic (SBP) and diastolic (DBP) blood pressure. HTN was diagnosed in accordance with the ESH/ESC 2013 guidelines based on the results of clinical BP and ABPM data [8, 9]. Statistical analysis was performed using a computer IBM PC/AT and the software package Excel and Statistica version 6.0. Parametric methods were used, and data are presented as mean values and standard deviation; Student and Mann-Whitney tests were used. Differences were considered significant  $p < 0.05$ .

### Results and discussion

The study included 114 patients with CAD aged from 38 to 85 years old. The groups were comparable by male: female ratio: 73.8 %; 26.2 % in the main group and 79.6 %; 20.4 % in comparison group ( $p > 0.05$ ), respectively. The duration of CAD in patients from the main group was significantly greater than in the comparison group:  $7.1 \pm 0.5$  vs.  $5.6 \pm 0.5$  years, respectively ( $p < 0.05$ ). According to ABPM data mean SBP/DBP was  $155.6 \pm 4.1/86.5 \pm 2.8$  mm Hg in the main group and  $131.4 \pm 3.9/72.8 \pm 2.1$  mm Hg in the comparison group ( $p < 0.001$ ). Before examination in the CMSEE the majority of the patients from both groups were engaged in the mental work (58.5 and 75.5 %, respectively,  $p > 0.05$ ), 41.5 % and 24.5 % subjects performed physical work in the main and comparison groups, respectively ( $p > 0.05$ ). Patients from the main group rarely ( $p < 0.05$ ) return to work than those from the comparison group. For example, 26.1 % patients from the main group returned to their previous employment (88.2 % had mental work, and 11.8 % — physical

work), while 46.9% patients returned to work in the comparison group (78.3% had mental work, and 21.7% — physical work). The lower rate of return to work in the main group may be due to lower professional orientation, lack of assistance in finding employment, which indicates the need for better professional rehabilitation in these patients. The occurrence rate of ECG-signs of left ventricular hypertrophy was significantly higher in the main group than in the comparison group (92.3 and 69.4%,  $p < 0.01$ ), which may be due to the myocardial remodeling in response to excessive BP load.

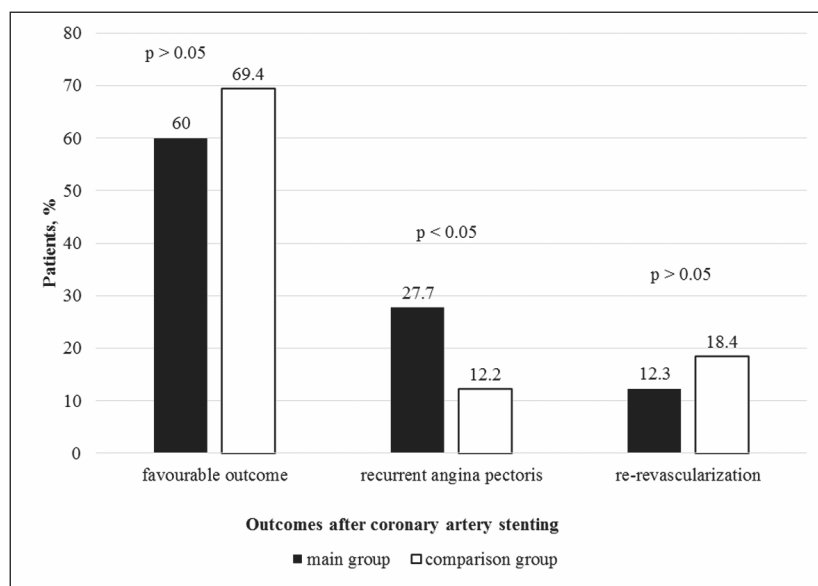
According to the results of the initial examination at CMSEE LVEF was similar in both groups ( $45.9 \pm 1.5$  and  $49.5 \pm 1.0\%$ , respectively,  $p > 0.05$ ). The rate of LV systolic dysfunction was 63.1% in the main group and 24.5% in the comparison group ( $p < 0.001$ ). According to the re-examination results the average EF was significantly lower in the main group than in the comparison group ( $48.1 \pm 1.0$  and  $56.3 \pm 1.1\%$ , respectively,  $p < 0.001$ ). After coronary artery angioplasty and stenting LVEF improved faster in CAD patients without HTN compared to the main group that might be related to the cardiac remodeling in hypertensive subjects.

We evaluated cardiovascular morbidity in both groups. The severity of clinical symptoms of angina pectoris 3–6 months after coronary angioplasty and stenting was comparable in both groups. FC II

angina pectoris was diagnosed in 67.3% in the main group and in 52.3% in the control group ( $p > 0.05$ ); FC III angina pectoris — in 14.3% and 21.5%, respectively ( $p > 0.05$ ). Chronic heart failure (CHF) II FC is more common in comparison group (49.2 and 73.5% in the main and comparison groups, respectively,  $p < 0.01$ ), while CHF FC III was more frequently recorded in the main group (44.6 and 20.4%, respectively,  $p < 0.001$ ). At the same time, HTN 3rd degree was registered in 86.2%, while HTN 2nd degree was found in 13.8% patients with FC III heart failure in the main group. We speculate that it might result from the lower compensatory possibilities in patients with CHD and uncontrolled HTN 3rd degree. The rate of MI was 87.7 and 85.7% in the main comparison groups, respectively ( $p > 0.05$ ), probably related to the patients selection for endovascular treatment. Diabetes mellitus was diagnosed in 10.2 and 21.5% patients in the main and comparison groups, respectively ( $p > 0.05$ ).

At primary examination in CMSEE by BEM, mean capacity of physical load was comparable in the study and comparison groups:  $59.7 \pm 5.1$  and  $68.7 \pm 4.3$  W, respectively ( $p > 0.05$ ). At 10–12-month re-examination the average power of the applied physical load was lower in the main group ( $63.9 \pm 4.0$  and  $80.3 \pm 50$  W, respectively,  $p < 0.05$ ). A similar trend was observed for the parameters of mean physical load assessed by ECG monitoring. Thus, at initial examination in

**Figure 1. Clinical outcomes of coronary angioplasty and stenting in patients from the main and comparison groups**





CMSEE it was comparable in both groups ( $609.2 \pm 45.7$  and  $706.1 \pm 49.1$  kg  $\times$  m, respectively,  $p > 0.05$ ), while 10–12 months later the average capacity of the physical load was significantly lower in the main group ( $615.1 \pm 39.1$  and  $743.4 \pm 45.6$  kg  $\times$  m, respectively,  $p < 0.05$ ). These data indicate lower compensatory possibilities in the study group and, as a consequence, worse rehabilitation prognosis.

Figure 1 presents the rate of the major clinical outcomes of coronary angioplasty and stenting in the studied groups. The rate of favorable outcomes was comparable in both groups. Higher rate of the recurrent angina pectoris FC II and III was in the main group. Among them 55.6% were males. Recurrent symptoms of CAD were observed in 38.8% in subjects with three-vessel disease, in 22.2% in patients with two-vessel lesions; in 22.3% — in patients with the lesions of the left anterior descending artery; in 16.7% — in patients with lesions of the main trunk of the left coronary artery. Among them 83.3% patients had HTN 3rd degree attained, and 16.7% subjects had HTN 2nd degree. The frequency of re-revascularization (due to the symptoms relapse within one year after coronary angioplasty and stenting) was comparable in both groups.

At primary examination in CMSEE disability of different severity was established (Table. 1):

disability of first degree was detected in 10.8% in the main group and in 8.2% in the comparison group ( $p > 0.05$ ). The disability of 2nd degree was detected in 26.2 and 24.5%, respectively ( $p > 0.05$ ), and the disability fo 3rd degree — in 60 and 51%, respectively. Cardiovascular disorders not leading to the disability were less frequent in the main group (3 and 16.3%, respectively,  $p < 0.05$ ).

At re-examination in CMSEE disability of 1st degree was established in 11.1 and in 7.3% in the main and comparison groups ( $p > 0.05$ ); disability of the second degree — in 31.7 and 24.4% ( $p > 0.05$ ), respectively; disability of the 3rd group — in 55.6 and 56.2% ( $p > 0.05$ ), respectively. The disability signs were not found in 1.6% in the main group and in 12.1% in the control group ( $p < 0.05$ ). The change in disability rates (increased number of patients without disability signs at primary and secondary examination) might reflect a better rehabilitation prognosis among patients with CAD without HTN compared to the hypertensives.

### Conclusion

Thus, the disability rates and rehabilitation prognosis after coronary angioplasty and stenting are worse in hypertensive patients with CAD compared to subjects with CAD without HTN. The rate of unrecognized disability is higher among patients with CAD without HTN than among

CHARACTERISTICS OF DISABILITY IN THE STUDY AND CONTROL GROUPS

Table 1

Disability category	Main group, n = 65	Comparison group, n = 49	p-level
Limited ability to work, 3 <sup>d</sup> degree, %	10.8	8.2	> 0.05
Limited ability to work, 2 <sup>nd</sup> degree, %	23.8	26.8	> 0.05
Limited ability to work, 1 <sup>st</sup> degree, %	65.4	65	> 0.05
Limited ability to self-service, 2 <sup>nd</sup> degree, %	15.4	10.2	> 0.05
Limited ability to self-service, 1 <sup>st</sup> degree, %	18.5	14.3	> 0.05
Reduced mobility, 2 <sup>nd</sup> degree, %	16.9	8.2	> 0.05
Reduced mobility, 2 <sup>nd</sup> degree, %	21.5	10.2	> 0.05

hypertensive subjects with CAD. The results of our study may indirectly indicate the higher need for rehabilitation, including medical rehabilitation (wider range of medical treatment, physiotherapy, optimization of physical activity and treatment at a health resort), professional rehabilitation (employment and the development of employment recommendations), and psychosocial rehabilitation.

**Conflict of interest.** The authors declare no conflicts of interest.

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