Silent myocardial ischemia in patients after emergency coronary intervention (literature reviev)

Isquemia miocárdica silenciosa en pacientes tras intervención coronaria de urgencia (revisión de la literatura)

Alsu Ildusovna Abdrahmanova[1], Nikolay Anatolevich Tsibulkin[2]
[1]Kazan Federal University, Tel. 89179226629; e-mail alsuchaa@mail.ru
[2]Kazan state medical academy; e-mail:cardiokgma@mail.ru

Received/Recibido: 08/12/2020 Accepted/Aceptado: 09/15/2020 Published/Publicado: 10/20/2020 DOI: 10.5281/zenodo.4443460

Abstract

In connection with the growing use of percutaneous coronary intervention in the coronary heart disease treatment, it is necessary to closely monitor, control the results, and prevent possible complications in patients. One of the complications of percutaneous coronary intervention is restenosis, which is accompanied by recurrence of anginal pain. And there is no clinic of restenosis with silent myocardial ischemia; therefore, the risk of myocardial infarction and sudden cardiac death increases. According to the literature, after percutaneous coronary intervention, silent myocardial ischemia is found in a quarter of patients, and silent myocardial infarction accounts for 22-78% of all infarctions after percutaneous coronary intervention. To determine the presence of myocardial ischemia and latent coronary insufficiency in order to timely diagnose restenosis and, ultimately, reduce complications, it is necessary to use stress tests. Imaging studies with stress tests, such as stress echocardiography and single-photon emission computed tomography, have high sensitivity and specificity (and availability). In the absence of clinical symptoms after percutaneous coronary intervention, the stress test is recommended in the first 2 years after revascularization. If patients have a high cardiovascular risk, after incomplete or suboptimal revascularization, stenting of small-diameter coronary arteries, bifurcation and/or ostial stenting, stress tests should be performed earlier, and imaging tests should be used as non-invasive diagnostic methods. Timely diagnosis and treatment of silent myocardial ischemia in patients undergoing percutaneous coronary intervention is an important task in general clinical practice.

Key words: silent myocardial ischemia, percutaneous coronary intervention.

Resumen

En relación con el uso creciente de la intervención coronaria percutánea en el tratamiento de la enfermedad coronaria, es necesario vigilar de cerca, controlar los resultados y prevenir posibles complicaciones en los pacientes. Una de las complicaciones de la intervención coronaria percutánea es la reestenosis, que se acompaña de recurrencia del dolor anginoso. Y no hay clínica de reestenosis con isquemia miocárdica silenciosa; por tanto, aumenta el riesgo de infarto de miocardio y muerte súbita cardíaca. Según la literatura, después de la intervención coronaria percutánea, la isquemia miocárdica silenciosa se encuentra en una cuarta parte de los pacientes, y el infarto de miocardio silencioso representa el 22-78% de todos los infartos después de la intervención coronaria percutánea. Para determinar la presencia de isquemia miocárdica e insuficiencia coronaria latente con el fin de diagnosticar oportunamente la reestenosis y, en última instancia, reducir las complicaciones, es necesario utilizar pruebas de esfuerzo. Los estudios de imagen con pruebas de estrés, como la ecocardiografía de estrés y la tomografía computarizada por emisión de fotón único, tienen una alta sensibilidad y especificidad (y disponibilidad). En ausencia de síntomas clínicos tras la intervención coronaria percutánea, se recomienda la prueba de esfuerzo en los 2 primeros años tras la revascularización. Si los pacientes tienen un alto riesgo cardiovascular, después de una revascularización incompleta o subóptima, la colocación de un stent en las arterias coronarias de pequeño diámetro, la bifurcación y/o la colocación de un stent ostial, las pruebas de esfuerzo deben realizarse antes y las pruebas de imagen deben usarse como métodos de diagnóstico no invasivos. El diagnóstico y tratamiento oportunos de la isquemia miocárdica silenciosa en pacientes sometidos a intervención coronaria percutánea es una

tarea importante en la práctica clínica general.

Palabras clave: isquemia miocárdica silenciosa, intervención coronaria percutánea.

Introduction

In silent myocardial ischemia (SMI), there are violations of perfusion, metabolism, function and electrical activity of the myocardium, which are not accompanied by clinical manifestations (anginal attack or its equivalents). These disorders are found in 2-57% of the population, in every eighth "almost healthy" person aged 55-75 years old[1]. SMI can be an independent form of coronary heart disease (CHD) or be combined with other forms of CHD. Silent ischemic episodes are recorded in 40-100% of persons with stable angina[2]. In the presence of SMI, the risk of sudden cardiac death (SCD) increases 10 times, cardiac arrhythmias - 2 times, myocardial infarction (MI) and congestive heart failure - 1-1.5 times[1,3]. Patients with CHD, having MI or SCD manifestations, may have undiagnosed asymptomatic myocardial ischemia for a long period of time[3,4].

Methods

We reviewed and analyzed the scientific publications devoted to SMI in patients undergoing percutaneous coronary intervention (PCI).

Results and Discussion

In recent years, PCI has become one of the treatment methods for coronary artery disease. In this regard, it becomes necessary to carefully monitor these patients, to control the PCI results, and to prevent possible complications. One of the complications after PCI is restenosis[5]. According to the results of studies, the incidence of restenosis is 8-12% on average, thrombosis within the stent is observed in about 0.87-2.2% of cases and usually develops within the first year after stent placement; in the vast majority of cases restenosis develops in terms 6-9 months after angioplasty[6].

Most often, restenosis of the coronary arteries (CA) is accompanied by relapse of anginal pain. If the patient does not have a classic angina attack or its equivalents, then there is no reason to limit or reduce the level of his/her physical activity, the patient does not attempt to avoid factors that may lead to an angina attack or its equivalents. If there are no clinical manifestations of the process progress, then there is no need to seek medical help, the appropriate treatment is prescribed untimely or not at all. The SMI presence leads to a worsening prognosis in patients after PCI: the MI, SCD risk increases, regardless of the clinical situation, restenosis is a predictor of mortality in the long term[7].

In some patients after PCI, restenosis may not be diagnosed, as SMI is found in a quarter of patients according to Bengtson J.R. et al.[4]. It is found in the work of Tavkaeva D.R. (2012) that SMI was detected in 6.6% of cases after 6 months, according to Holter ECG monitoring in the group of patients who underwent CA stenting. And according to CAG data, stent restenosis was revealed in these patients, which led to repeated "stent in stent" stenting[8].

The prevalence of silent MI after PCI is not fully understood. There was a multicenter study, which randomized 15,991 patients underwent PCI. Within 2 years after PCI, Q-wave MI was confirmed in 186 (1.16%) patients, most of them (78%, 146 of 186) were classified as silent MI due to the absence of clinical manifestations. Silent MI accounted for 22.1% of all MI types (146 out of 660)[9].

A special group is patients in whom SMI was identified before PCI. In these patients, the clinical predictors of delayed adverse cardiovascular events (CVE) remain uncertain. The most common late CVE in this group of patients are acute coronary syndromes with and without ST-segment elevation, coronary artery revascularization, thrombosis of a previously inserted stent, hospitalization due to heart failure, and all-cause mortality. During follow-up for a year and a half (2019), Doi S. et al. found late adverse cardiovascular events in 10-15% of cases, where more than 60% was represented by repeated revascularization[10]. Chronic kidney disease (CKD) and diabetes mellitus (DM) are very important factors in the development of late CVE in patients with SMI, which increase their risk by more than 8 times. The presence of CKD or diabetes mellitus can serve as an indicator of late unfavorable CVE in silent myocardial ischemia even after a successful PCI procedure[10,11].

According to a number of authors, there is a risk of recurrent SMI in patients with SMI, even after a successful PCI, with complete or partial revascularization. It was found that after PCI, ischemia was determined in every fifth patient and was silent in half of the cases[12].

To determine the presence of myocardial ischemia and latent coronary insufficiency in order to timely diagnose restenosis and, ultimately, reduce complications, it is necessary to use stress tests. Imaging studies with stress tests, such as stress echocardiography (Stress - EchoCG) and single-photon emission computed tomography (SPECT), have high sensitivity and specificity (and availability)[13,14].

Stress-EchoCG reveals the degree of impaired local contractility of the left ventricle (LV) myocardium, the presence of hemodynamically significant coronary artery stenoses, to determine the pool of stenotic coronary artery and exercise tolerance. Stress-EchoCG can be used as a screening method to monitor patients after PCI to avoid routine CAG. Stress-EchoCG makes it possible to identify a group of patients with a high risk of restenosis, to determine the indications for repeated PCI, as well as to assess the prognosis of patients after revascularization[15].

Conducting perfusion SPECT in the ECG synchronization mode allows visualizing the kinetics of the myocardial walls in different phases of the cardiac cycle and thereby simultaneously assessing the functional state of the LV myocardium. Contractility is assessed simultaneously with the main perfusion protocol, without increasing the total study time, while the obtained data on LV contractility are quite accurate and reproducible[16]. SPECT combination with a stress test (ST) helps to identify coronary stenosis among people with SMI, because when the coronary vessel stenosis is less than 85%, there is no decrease in blood flow in the conditions of functional rest in most cases and almost 70% of acute coronary events are the result of coronary lesions, which are not hemodynamically significant. The provoked heterogeneity of blood flow is manifested on scintigrams by defects in myocardial perfusion of varying severity. The appearance of stress-induced perfusion defects in patients with coronary insufficiency is usually accompanied by impaired LV contractility. After the stress is terminated, the majority of patients experience a rapid recovery of the heart contractile ability, however, in about 30–35% of cases, the inotropic dysfunction persists for an hour after the stress test. Such long-term persistence of stress-induced LV dysfunction is considered an early predictor of coronary thrombosis and can be used as a non-invasive marker of the severity of vascular damage. When performing SPECT with ST in patients with effective PCI after 6 months, there were found some signs of SMI development in 14% of patients, and perfusion disorders were detected in the blood supply segments of the target vessel. At the same time, when compared with patients with painful myocardial ischemia, it was found that ischemia occurred at a lower threshold stress in patients with SMI[17].

A number of authors recommend performing ST in all patients after PCI with a high risk of CVE; however, other studies demonstrate the lack of benefit of this approach, as well as the lack of an association between the revealed myocardial ischemia and the need for repeated PCI[18].

The ADORE (Aggressive Diagnosis of Restenosis) study results showed that there was no need for SMI screening by ECG at 6 weeks and stress test with SPECT at 6 months after PCI, compared with the stress testing in patients with painful myocardial ischemia. This study did not reveal a significant difference between these groups of patients in predicting the likelihood of MI, survival, functional status, quality of life, and the frequency of invasive cardiac procedures after 9 months of follow-up after PCI[17].

An individual approach, which depends on clinical and angiographic risk factors for the development of restenosis, is of great importance in choosing the tactics of managing patients after PCI[4,18,19]. In the absence of symptoms, stress testing in patients underwent PCI to confirm the preservation of correction results of CA lesions is necessary after incomplete or suboptimal revascularization and in certain asymptomatic patient subgroups[20]. Since the factors that increase restenosis risk are the presence of diabetes or CKD, stenting of small-diameter CA, bifurcation and/or ostial stenting, etc., these patients are included in the above-mentioned certain asymptomatic patient subgroups[4].

If the condition after PCI is stable, the patients should undergo dispensary examination with a regularity of once every six months[13]. In the absence of clinical symptoms after PCI, ST is recommended to be performed not earlier than 2 years after revascularization[21]. A number of researchers recommend performing radionuclear research methods after revascularization in asymptomatic course during the first 2 years after PCI[22]. If patients have a high cardiovascular risk, ST should be carried out earlier, and imaging stress tests should be used as non-invasive diagnostic methods.

Summary

Thus, SMI is an important predictor of worsening prognosis in patients after PCI (emergence of stent restenosis, MI, etc.), as well as an important prognostic indicator of the severity of organic CA changes according to CAG data. Therefore, to determine the presence of myocardial ischemia and latent coronary insufficiency in order to timely diagnose restenosis and, ultimately, reduce complications, it is necessary to use stress tests with vizualization.

An individual approach is required to each patient after PCI.

Conclusions

Timely diagnosis and treatment of SMI in patients underwent PCI is an important task in general clinical practice.

Acknowledgements

The work is performed according to the Russian Government Program of Competitive Growth of Kazan Federal University.

References

1. A.I. Abdrakhmanova, N.B. Amirov, G.B. Sayfullina Painless myocardial ischemia (literature review). Bulletin of modern clinical medicine. № 6, pp. 103—115, 2015

2. N.B. Amirov, A.I. Abdrakhmanova, G. B. Sayfullina, et al. Painless myocardial ischemia. Kazan "Medicine", 83 p, 2018

3. E.Z. Golukhova, O.I. Gromova, N.I. Bulaev, et al. Sudden cardiac death in patients with coronary heart disease: from mechanisms to clinical practice. Cardiology. № 12, pp. 73-81, 2017

4. N.P. Mitkovskaya, I.V. Pateyuk, T.V. Statkevich, et al. Painless myocardial ischemia in patients with metabolic syndrome: stratification of cardiovascular risk. Life Sciences News. № 3, pp. 39— 42, 2015

5. M.A. Elkanova, V.N. Shitov, U.V. Botvina, et al. Detecting painless myocardial ischemia in a patient with restenosis after percutaneous coronary intervention. Atherothrombosis. № 1, pp. 101-107, 2016

6. G.A. Berezovskaya, V.I. Ganyukov, M.A. Karpenko Restenosis and in-stent stenosis: pathogenetic mechanisms and prognostic markers. Russ J Cardiol, vol. 98, № 6, pp. 91-95, 2012

7. S. Cassese, R.A. Byrne, S. Schulz, et al. Prognostic role of restenosis in 10 004 patients undergoing routine control angiography after coronary stenting. European Heart Journal, vol. 36, № 2, pp. 94-99, 2015

8. D.R. Tavkaeva, S.D. Mayanskaya The structure of painless myocardial ischemia in patients with myocardial infarction after percutaneous coronary intervention or conservative therapy. Theses of the All-Russian Conference "Contradictions of Modern Cardiology: Controversial and Unresolved Issues". Samara. pp.181,2012

9. C.C. Chang, E. Spitzer, P. Chichareon, et al. Ascertainment of Silent Myocardial Infarction in Patients Undergoing Percutaneous Coronary Intervention (from the GLOBAL LEADERS Trial). Am J Cardiol, vol. 124, №12, pp. 1833-1840, 2019

10. S. Doi, M. Suzuki, T. Funamizu, et al. Clinical Features of Potential After-Effects of Percutaneous Coronary Intervention in the Treatment of Silent Myocardial Ischemia. Heart Vessels, vol. 34, №12, pp. 1917-1924, 2019

11. D. Perera, T. Crake, V. Lee, et al. Angiography-guided Multivessel Percutaneous Coronary Intervention Versus Ischemia-guided Percutaneous Coronary Intervention Versus Medical Therapy in the Management of Significant Disease in Non-Infarct-related Arteries in ST-Elevation Myocardial Infarction Patients With Multivessel Coronary Disease. Crit Pathw Cardiol, vol. 17, № 2, pp. 77-82, 2018

12. V.P. Lupanov Painless myocardial ischemia: diagnosis, drug and surgical treatment, prognosis. Consilium Medicum, vol. 14, № 10, pp. 36-44, 2012.

13. Recommendations for the treatment of stable coronary heart disease 2013 (ESC). Russian Journal of Cardiology, vol. 111, № 7, pp. 7-79, 2014

14. Recommendations of the European Echocardiographic Association. Stress echocardiography: Consensus of experts from the European Echocardiographic Association (EAE). Russian Journal of Cardiology, vol. 102, № 4 (2), pp. 1-28, 2013

15. M.M. Elkanova, V.N. Shitov, S.E. Botvina, et al. Comparison of the diagnostic capabilities of stress echocardiography and exercise ECG in patients with different severity of coronary lesions. Cardiological Bulletin, vol. 10, № 2, pp. 30-40, 2015

16. E.V. Mikhailov, Yu.Yu. Shamurova, I.V. Tantsyreva, et al. Myocardial perfusion scintigraphy and percutaneous coronary intervention in patients with stenotic lesion of the coronary arteries. Ural Medical Journal, vol. 165, № 10, pp. 60-67, 2018

17. Serge. C. Harb, M.D. Thomas Cook, et al. Exercise Testing in Asymptomatic Patients After Revascularization Are Outcomes Altered? Arch Intern med published online May 14, 2012 Available from: url:www.archinternmed.com

18. M.J. Eisenberg, B. Wilson, C. Lauzon, et al. Routine functional testing after percutaneous coronary intervention: results of the aggressive diagnosis of restenosis in high-risk patients (ADORE II) trial. Acta Cardiol, vol. 62, № 2, pp.143-150, 2007

19. S.C. Harb, T.H. Marwick. Prognostic value of stress imaging after revascularization: a systematic review of stress echocardiography and stress nuclear imaging. Am Heart J, vol. 167, № 1, pp. 77-85, 2014

20. W. Acampa, M.P. Petretta, S. Daniele, et al. Myocardial perfusion imaging after coronary revascularization: a clinical appraisal. European Journal of Nuclear Medicine and Molecular Imaging, vol. 40, № 8, pp. 1275-1282, 2013

21. Recommendations of the European Society of Cardiology and the European Association of Cardiothoracic Surgeons on myocardial revascularization from 2014. Russian Journal of Cardiology, vol. 118, № 2, pp. 5-81, 2015

A.A. Shilov, N.A. Kochergin, V.I. Ganyukov, et al. Comparability of scintigraphy data with coronary angiography after surgical myocardial revascularization. Regional blood circulation and microcirculation, vol. 18, № 3, pp. 23-28, 2019.