https://doi.org/10.38109/2225-1685-2018-2-52-62

ISSN 2225-1685 (Print)
ISSN 2305-0748 (Online)

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PECULIARITIES AND SURGICAL TREATMENT TACTICS OF POSTERO-BASAL LEFT VENTRICULAR ANEURYSMS

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ANNOTATION

The literary review reflects the main current data on the problem of surgical treatment of postero-basal left ventricular aneurysms. It is shown that, despite the small percentage of these aneurysms in patients with coronary heart disease (CHD), their importance for surgical treatment is significant, since the effective correction of detected disorders of cardiac structures, myocardium and coronary arteries has not been sufficiently developed to date, and many issues of surgical tactics are contradictory. This applies both to the type of geometric reconstruction of the left ventricle, and the feasibility of mitral regurgitation correction, which due to dysfunction of the papillary muscles is observed in almost all patients with postero-basal aneurysms of the heart. The question of the combined correction of the interventricular septum rupture in patients with postero-basal aneurysms remains complex and unresolved until now. The relevant problem is the choice of surgical tactics of left ventricular reconstruction using two patches in the presence of anteroposterior aneurysms. All of the above reflects the need for further research on the problem of surgical treatment of postero-basal aneurysms of the heart.

Keywords: *coronary heart disease, left ventricular postero-basal aneurysms, surgical treatment.*

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For citation: Chragyan V.A., Arutyunyan V.B., Kadyraliev B.K, Mialiuk P.A., Vronskiy A.S., Lilothia S.H. Features and surgical treatment of posterior-basal left ventricular aneurysms. Eurasian heart journal. 2018, May 25; 2:58-62.

In most cases, heart aneurysms are formed after a transmural myocardial infarction due to occlusion of one of the major coronary arteries. Injuries and wounds of the heart with damage of the coronary arteries as a cause of aneurysm are no more than 1% of all cases. Most often there are aneurysms of the left ventricle (LV).

According to their localization, left ventricular aneurysms are classified as **anteroseptal-apical** and, much less frequently, as postero-basal, while false aneurysms of the postero-basal region of the left ventricle arise as a result of a wall rupture due to myocardial infarction, as well as a complication of a mitral valve replacement. The peculiarity of false aneurysms is the susceptibility to bleeding and the emergency nature of surgical treatment [2, 7, 10, 13, 14, 18, 22].

Morphologically, cardiac aneurysm is supposedly the area of a thinned, noncontracting scar tissue that is demarcated from a well-preserved myocardium and that bulges over it. Clinically, left ventricular aneurysm is characterized as a section of the LV wall scarring, which is visually distinguished by a lack of movement (akinesia) during the cardiac cycle or paradoxical movement (dyskinesia). Depending on the area of the aneurysmal sac (in relation to the volume of the left ventricle in diastole), aneurysms are divided into small (10-15%), medium (16-20%), large (21-40%) and giant (25%) [15, 20, 36].

Currently, the most effective treatment method for patients with postinfarction heart aneurysm is surgical, which is confirmed by good immediate and long-term results. Thus, surgical mortality in these patients is 6,9-10,4%, and 10-year survival-56-62%, which convincingly confirms the effectiveness of the surgical method in the treatment of patients with heart aneurysm[1, 9, 12, 15, 18, 23].

Frequency, clinical picture and diagnostics peculiarities of postero-basal heart aneurysms

According to a few studies, the frequency of postero-basal heart aneurysms is 5.4-9.8% out of the total number of left ventricular aneurysms [1, 2,15, 19, 34].

As a rule, postero-basal aneurysms are formed after myocardial infarction as a result of right coronary artery damage or circumflex branch of left coronary artery. In 50% of patients there is a combined damage of these arteries. Since posterior myocardial infarctions in most cases are not diagnosed on time, patients tolerate myocardial infarction "on their feet", and this contributes to the occurrence of heart aneurysm.

Despite the significant increase in the number of women with postero-basal heart aneurysms in recent years, men are the dominant patients with this pathology. In 12-18% of cases patients with postero-basal aneurysms of the heart have an anterior wall aneurysm, especially if they have a "circular" myocardial infarction.

Since transthoracic electrocardiographic examination is not an informative method of postero-basal heart aneurysm diagnosis, an accurate diagnosis can be made only on the basis of coronary and ventricular angiography results, as well as transesophageal echocardiography [16, 27]. In most cases, the postero-basal heart aneurysms have a shape of a sac, and its configuration is well visible during ventricular angiography and is easily determined by left ventricle shape change during systole and diastole.

A number of researchers divide aneurysms into small, medium and large ones, while separating the aneurysms with an end-diastolic volume over 400 ml, since at such volumes the sac drops into the left pleural sinus and gets tightly adhered to the pericardium and lung tissue, which creates significant difficulties in surgical treatment [2, 15, 18, 24, 33].

Clinical signs of congestive heart failure, cardiac arrhythmias and cerebral stroke are typical for patients with postero-basal aneurysms in combination with a rupture of the interventricular septum, as well as postero-basal aneurysms with the volume more than 400 ml. Clinical signs above are the result of a severely reduced contractile function of left ventricle as a consequence of myocardial ischemia, increase in the volume of LV, localization of the aneurysm itself and cardiac complications where left ventricle can not support an adequate contractile function. At the same time, decrease in the pumping function of the heart and increase in the volume of its chambers due to postero-basal aneurysm lead to the development of relative mitral insufficiency in 52% of patients with increased systolic pressure in the pulmonary artery and the occurrence of atrial fibrillation in 13% of patients. Factors such as partial or total adhesive pericarditis, which are detected during surgery in 56% of patients, as well as the presence of a rupture of the interventricular septum in 8-12% of patients, aggravate the course of the disease and complicate surgical treatment [2, 3, 17, 21, 30].

Indications for surgery and surgical risk factors

It should be noted that the presence of postero-basal heart aneurysm significantly aggravates the clinical condition of the patient and increases the degree of operational risk. Based on this, a number of researchers [25, 26, 28, 35] divide the indications for surgical treatment of postero-basal aneurysms into two groups:

- urgent - the presence of severe heart failure due to rupture of the interventricular septum or severe mitral valve insufficiency, as well as signs of postinfarction aneurysm wall rupture;

- routine – heart failure and frequent episodes of angina pectoris due to significant coronary artery and myocardial damage, as well as rhythm disorder, the cause of which are postinfarction scar areas of heart aneurysm.

Relative contraindications for surgical treatment of postero-basal heart aneurysms are pulmonary hypertension (pulse pressure (PP) > 60 mm of Hg.) with mitral regurgitation, asynergia more than 60% of the left ventricular myocardium. It should be noted that these contraindications do not exclude the possibility of a favorable outcome of the operation, but indicate an increased degree of operative risk and the importance of conducting a thorough examination of the patient to assess his operability.

In recent years, myocardial viability studies were conducted in the areas of cardiac aneurysm using magnetic resonance and single photon emission computed tomography, which significantly expands the possibility of preoperative assessment of myocardial damage and the degree of operative risk [5, 8]. At the same time, absolute contraindications for surgical treatment of postero-basal aneurysms, except postinfarction rupture of the interventricular septum, is insufficient function of the right ventricle with low ejection fraction, systolic displacement of the tricuspid annulus less than 13 mm, as well as pulmonary hypertension (PP > 60 mm Hg) without mitral regurgitation.

Currently hospital mortality in surgical treatment of heart aneurysms, including postero-basal, is one of the main problems. However, its rate varies depending on the type of surgery and the initial condition of the patients. Thus, in patients with a total ejection fraction less than 30% the mortality is 12%, and when performing operations on emergency indications – up to 22%. Recent studies have revealed a decrease in hospital mortality to 3-7% in left ventricular endoventricular plasty, compared with 10-20% in the period of postinfarction heart aneurysm surgery establishment [4, 7, 10, 15, 29].

There are several groups of causes of surgical risk in patients with postero-basal aneurysms: clinical, functional and geometric. Clinical factors of increased surgical risk are multiple myocardial infarction history, III-IV NYHA functional classes of heart failure. Important functional factors of surgical risk are a significant reduction of total and segmental left ventricular ejection fraction and its end-diastolic diameter (EDD) > 2.5 cm, transverse axis shortening < 20%. Thus, irrespective of left ventricular plasty method and revascularization extent, mortality in patients with EDD > 2.5 cm remains the most high [18, 31, 37]. Geometrical criterias for high surgical risk are end-diastolic diameter of the aneurysm > 40% of the LV perimeter, LV end-diastolic volume increase and diverging geometry of the LV walls [38, 39].

The severity and nature of coronary artery disease in patients with LV postero-basal aneurysm are important risk factors for hospital mortality.

Significant functional factors of surgical risk also include stenosis of the left coronary artery trunk or lesion of the three main coronary arteries, having the completeness of myocardial revascularization a significant impact on the outcome of the operation, since adequate restoration of LV function is observed only with complete myocardial revascularization. In 2006. the RESTORE group revealed that preoperative mitral regurgitation, more frequent in patients with large volumes of LV and lower ejection fraction, is an independent factor of operational mortality risk [17, 21, 29].

Ventricular tachyarrhythmias are also one of the most dangerous

risk factors for postoperative mortality in postero-basal aneurysms of the heart [9 ,18]. In 2005 U. Sartipy et al. [36] identified the main risk factors for mortality and re-hospitalization according to the analysis of immediate and long-term treatment results of 136 patients that underwent geometric reconstruction of LV due to cardiac aneurysm. Operational mortality was 7.4%. Elderly age, diabetes and III-IV degree mitral valve insufficiency were reliable factors of operative mortality. Significant risk factors for re-hospitalization and sudden cardiac death of patients who underwent surgery were elderly age and a high degree of mitral regurgitation. However, J. Williams et al. showed good results of adequate operation of left ventricular geometric reconstruction in elderly patients [21].

Tactical aspects of the surgical treatment

It should be noted that the worldwide experience of operations in postinfarction aneurysms of LV posterior wall is relatively little and there is no standardized technique for performing such interventions [1, 2]. Despite the fact that almost all cardiac surgeons recognize the concept of the most complete myocardial revascularization with the reconstruction of the left ventricle and correction of cardiac complications (rupture of the interventricular septum and mitral regurgitation) as a basis of surgical treatment of postero-basal heart aneurysms, opinions on the completeness of the main stages of reconstruction are contradictory and still raise the following questions:

- the effectiveness and feasibility of linear and endoventricular geometric reconstruction of the left ventricle in patients with different types of postero-basal aneurysms; – surgical tactics in patients with small aneurysms of the postero-basal heart region; – indications and the feasibility of performing operations on the mitral valve depending on the degree of mitral regurgitation; – surgical treatment of LV posterior-anterior aneurysms.

Number of researchers [1, 15] believe that small postero-basal aneurysms, which have a preserved muscle structure with a small area of protrusion, are not subject to reconstruction, and can be limited only to myocardial revascularization, especially the right coronary artery system. At the same time if the dome of protrusions is presented as a connective tissue, furthermore, with II–III degree mitral regurgitation, it is necessary to implement a linear plasty and eliminate mitral regurgitation, because such aneurysms may increase which leads to worsening of the mitral insufficiency degree.

M. M. Alshibaya et al. [1, 2] based on their own experience of surgical treatment of LV postero-basal aneurysms believes that in the presence of LV posterior wall aneurysm it is necessary to perform its correction more widely, while linear plasty is indicated for smaller sized aneurysm. When the size of the aneurysm is more than 5 cm in diameter, LV posterior wall plasty with synthetic patch is indicated. For LV posterior wall aneurysm plasty an oval patch corresponding in size and configuration with aneurysm sac ostium should be used. In the presence of mitral regurgitation caused by dysfunction of the posterior papillary muscle it is necessary to bring together the papillary muscles and perform mitral valve fibrous ring plasty in patients with annular dilatation. At the same time a mandatory component of the intervention is complete myocardial revascularization of all affected coronary arteries with the bypass surgery. If the patient has medium, large and giant posterior aneurysms, the indications for surgery are absolute, especially with giant sized aneurysms which have a great risk for patient's life and an increased degree of surgical intervention complexity for the surgeon as well as high hospital mortality. Currently, the main type of left ventricle reconstruction in such patients is the Dor geometric reconstruction operation with different modifications [1, 18, 23, 35]. The presence of relative mitral insufficiency of varying degrees in 48-50% of patients with postero-basal aneurysms often requires mitral valve plasty, and in 6-10% – mitral valve replacement [9, 11, 30, 32, 39]. Despite the number of reports about significant decrease in the degree of mitral regurgitation after an adequate myocardial revascularization and left ventricular remodeling [1, 4, 29], it is still impossible to predict the course of II degree mitral regurgitation and especially III degree one in the long term after the operation which requires further research.

The question of surgical treatment's expediency in patients with anterior-posterior heart aneurysms is complex and poorly studied. Due to severe clinical condition caused by significant disorders of myocardial contractile ability these patients are considered candidates for heart transplantation [17, 18]. At the same time, an encouraging factor was a report about successful left ventricle geometric reconstruction operation using two (posterior and anterior) synthetic patches [1, 2].

The results of surgical treatment

In the literature on surgical treatment of postinfarction heart aneurysms there are sporadic reports on results of the left ventricle postero-basal aneurysms operations. This is due to the fact that the results of their surgical treatment are analyzed in the general group of patients with heart aneurysms, without the allocation of a small subgroup.

J. Raman et al. [33] carried out a comparative analysis of surgical treatment results in two groups of patients: those with postero-basal aneurysms (17 patients) and those with anterior aneurysms (86 patients). Except myocardial revascularization all patients underwent Dor LV reconstruction, and 13 patients from the posterior aneurysms group had mitral valve plasty due to severe mitral regurgitation. Authors noted a good clinical effect of the operation in both groups and the absence of significant differences in the evaluation of immediate and long-term (up to a year) results. Operational mortality in the 1st group was 5.8%, in the 2nd-7%. In a year 73 and 77% of patients of the 1st and 2nd groups respectively belonged to the I NYHA functional class. The conclusion about the effectiveness of postero-basal aneurysms surgical treatment of patients with a low degree of operative risk was made.

According to V. I. Ursulenko et al. [15], the proportion of patients with postero-basal aneurysms is 5.4% of the total number of patients with cardiac aneurysms, while 3.4% of patients require surgery. Out of 58 patients with postero-basal aneurysms resection of the aneurysm was performed in 35 patients. Operational mortality was 2.8%. The authors' developed method of the postero-basal aneurysm resection "from the inside" with left ventricular plasty using patient's own tissues showed a significant reduction of the end-diastolic volume by 41.8% with an increase in the LV ejection fraction by 27%, while radiocontrast ventriculography revealed a good effect in the LV geometry reconstruction.

Of interest are two studies on comparative evaluation of immediate and long – term results of surgical treatment in two groups of patients - with linear plasty and Dor LV geometric reconstruction.

So P. Antunes et al. [17] and R. Lange et al. [23] found no significant differences in the treatment of postinfarction heart aneurysms by linear plasty or Dor LV reconstruction based on the evaluation of immediate and long-term results. It is concluded that the method of LV reconstruction should be selected individually for

each patient, based on the size, shape and number of scar changes of the left ventricle, while for small heart aneurysms a simple and gentle method of linear plasty can still be in demand. At the same time P. Klein et al. [27] on the basis of the analysis of both immediate and long-term results of surgical treatment of heart aneurysms (1233 patients) among which posterior aneurysms were 6,7%, showed a significant advantage of Dor LV geometric reconstruction over linear plasty. The total mortality rate in the analyzed group of patients was 6,9%. In the group of patients with heart failure (33% of cases) surgical mortality was 11%, long-term (3-year period of observation) mortality was 15.2%. Adequately executed myocardial revascularization reduces the degree of operative risk, while the need for surgical interventions on the heart valves increases the degree of operative risk in patients with postinfarction heart aneurysm.

Logistic regression analysis revealed no clinical or hemodynamic factors that could predict the outcome of the operation. Thus, surgical treatment of patients with postoperative heart aneurysms is one of the most complex and relevant methods of coronary surgery. Available research results are scanty and controversial, especially with regard to surgical tactics and evaluation of treatment outcomes. All of this requires further research to improve and refine the results.

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Accepted for publication: 04.10.2018