

Хірургічне лікування мітрального стенозу, ускладненого масивним тромбозом лівого передсердя

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Surgical treatment of mitral stenosis, complicated by massive thrombosis of the left atrium

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Реферат

Мета. Проаналізувати особливості хірургічного лікування мітрального стенозу, ускладненого масивним тромбозом лівого передсердя.

Матеріали і методи. Аналізовану групу склали 344 пацієнти, прооперовані в Інституті. Масивним тромбозом лівого передсердя вважали, коли тромботичні маси займали не менше третини його об'єму, не рахуючи вушка.

Результати. Госпітальна летальність після заміни мітрального клапана становила 4,2% та прямо залежала від ступеня тромбозу лівого передсердя ($p < 0,05$). Після відкритої мітральної комісуротомії госпітальної летальності не спостерігали, що свідчить про доцільність видалення тромботичної матриці.

Висновки. Під час операції з приводу масивного тромбозу лівого передсердя важливо повністю видалити материнську основу тромботичної вистілки та ліквідувати вушко лівого передсердя, що суттєво знижує ризик летальності та тромбоемболічних ускладнень на госпітальному етапі. Комп'ютерна томографія голови та органів черевної порожнини перед операцією є обов'язковою умовою для виключення непомітної тромбоемболії.

Ключові слова: масивний тромбоз лівого передсердя; протезування мітрального клапана; відкрита мітральна комісуротомія; штучний кровообіг.

Abstract

Objective. To analyze the peculiarities of surgical treatment of a mitral stenosis, complicated by massive thrombosis of left atrium.

Materials and methods. The group analyzed, operated in the Institute, consisted of 344 patients. Thrombosis of left atrium was considered a massive, when thrombotic masses have occupied no less than one third of its volume, not mentioning an auricle of atrium.

Results. Hospital lethality after change of a mitral valve have constituted 4.2% and directly depended on from a degree of the left atrium thrombosis ($p < 0.05$). After open mitral commissurotomy hospital lethality was not observed, witnessing the expediency of the thrombosis matrix extraction.

Conclusion. During the operation for a massive thrombosis of left atrium it is important to remove a maternal base of thrombotic bed and to eliminate the left atrium auricle, what lowers essentially the risk for lethality and thromboembolic complications on a hospital stage. Doing preoperative computed tomography of head and abdominal organs constitutes obligatory condition for exclusion of a hidden thromboembolism occurrence.

Keywords: massive thrombosis of the left atrium; prosthesis of mitral valve; open mitral commissurotomy; artificial blood circulation.

Introduction

Left atrium massive thrombosis is one of the complicated mitral valve acquired diseases surgery sections [1, 2, 4]. It makes 5% in the structure of 4 degree mitral stenosis [6 – 10]. Despite existing experience, hospital mortality with the presence of left atrium massive thrombosis still exceeds the limit at mitral stenosis uncomplicated correction [3 – 5]. Mitral disease surgical treatment combined with left atrium massive thrombosis is a surgery of elevated risk and is followed by increased hospital mortality due to increased danger of thromboembolic complications during hospital period [4 – 8].

Materials and methods

Analyzed group consisted of 344 patients with mitral stenosis, complicated by left atrium massive thrombosis that were on hospital treatment in National M. M. Amosov Institute of Cardiovascular Surgery of National Academy of Medical Sciences

of Ukraine within the period from January 01, 1984 till January 01, 2015. Left atrium massive thrombosis was diagnosed when thrombotic masses occupied not less than one third of atrium volume, excluding its appendage. Pure or prevailing mitral stenosis was observed in all cases. 95 (27.6%) patients were in class III of New York Heart Association Functional Classification (NYHA) and 249 (72.4%) patients – in class IV. Patients with assident aortic valve correction were excluded from the study.

There were 142 (41.3%) men and 202 (58.7%) women. The age of the patients was 58.8 ± 9.1 (20 – 71 years old). The average duration of atrial fibrillation was 4.1 ± 0.8 years and rheumatic disease – 19.1 ± 4.3 years. Atrium fibrillation constant form was observed in 97.8% (327 patients) and paroxysmal form – in 2.2% (17 patients). Sinus rhythm was present in 2 (0.6%) cases. Disease rheumatic origin also in combination with lipidosis, dysplasia and mucoid degeneration were observed in 100% of the cases.

Left atrium mitral thrombosis spread level was not even, starting from 33% of left atrium volume up to subtotal, what in turn defined the unevenness of clinical course. This made it necessary to classify the patients in 3 degrees of left atrium mitral thrombosis, depending on correlation of thrombotic masses and left atrium size. I degree included 33 (9.6%) patients with thrombotic masses volume of 33% of atrium volume, II degree – 102 (29.7%) patients with thrombotic mass volume within 34 – 50% from left atrium volume and III degree – 209 (60.8%) patients with thrombotic mass volume from 51% and upwards from left atrium volume.

The distinctive feature of left atrium mitral thrombosis is a dense adherence between thrombotic tissue base (“matrix”) and left atrium endocardium, apart from thrombotic mass volume deposition. It concerns first of all II and III degrees of left atrium mitral thrombosis, where thrombotic mass had dense adherence with left atrium wall (matrix base), including the area of left atrium appendage. In 3 cases of I degree of left atrium mitral thrombosis (33 cases total), left atrium appendage area was not included in thrombosis formation (0.6% in all left atrium mitral thrombosis cases) and in 4 cases (0.8% from all left atrium mitral thrombosis cases) there was a thrombotic tissue in this group.

Offered classification allows severity evaluation of surgery patients, determination of surgery volume and post-operative period forecast. Classification of a number of clinical parameters depending on left atrium mitral thrombosis degree is shown in *Table 1*.

According to the data from *Table 1*, the values of I degree of left atrium mitral thrombosis patients were significantly different from other patients’ values with II and III degree of left atrium mitral thrombosis ($p < 0.05$). It fully corresponded to the pathology anatomic substrate. In fact, the values in patients with III degree of left atrium mitral thrombosis were clinically the most severe, showing extreme risk of surgery due to long presence of rheumatic disease and atrium fibrillation.

Thromboembolia of systemic blood circulation vessels was observed in 79 patients’ past medical history (22.9%), 15 from them (4.4%) had it multiple times. It was a pathognomonic criterion for this patients’ category (every fifth). Permanent atrium fibrillation with average duration of (3.5 ± 0.5) years and rheumatic disease with average duration of (21.1 ± 4.5) years were observed in all patients. Thromboembolic complications were observed during (2.1 ± 0.3) years before surgery. It is also important to mention, that in 13 (3.8%)

cases such complications were not noticed by the patients and were discovered only during autopsy (post-stroke cysts of brain, kidneys and spleen). This happened during left atrium mitral thrombosis formation, when small thrombus seeding took place unnoticed by the patients and without clinical expression. In any case, preoperative thromboembolic complications (obvious and hidden) influenced patients’ clinical course. For this reason, it is always necessary to perform complete body CT-scan in all patients with left atrium mitral thrombosis before surgery.

In the majority of preoperative thromboembolic complication cases thromboembolia in brain vessels dominated in 71 patients (89.8% of patients with thromboembolia), including 3 patients with retina vessel thromboembolia. 19 (28.4% from all patients with thromboembolia in brain vessels) patients among them had residual effects of cerebral circulation disorders in the form of hemiparesis at the moment of admission to the hospital.

Preoperational thromboembolic complications were observed in I degree of left atrium mitral thrombosis in 18.2% ($n = 6/33$), in II degree in 21.6% ($n = 22/102$) and in III degree in 24.4% ($n = 51/209$) ($p < 0.05$). Thus, a direct proportion between thromboembolic complications prior to surgery and intensity of left atrium mitral thrombosis was observed.

All patients had high tendency to thrombogenesis and apart from atrium fibrillation it was also determined by such blood values as: hemoglobin (159.1 ± 14.5) g/l, hematocrit 0.46 ± 0.02 and thrombocytes 280.5 ± 14.5 .

Previous surgery was carried out in 104 patients (30.2%) mostly with a closed method. Among them 97 patients (93.3% among repetitive surgeries) had closed mitral commissurotomy, another 4 (3.8%) had closed recommissurotomy, and another 3 (2.9%) had open mitral commissurotomy.

Calcinosis was diagnosed in 277 (66.0%) patients among 344, including: I degree calcinosis in 33 (9.6%) patients, II – in 96 (27.9%) and III – in 98 (28.5%). Noticeable fibrotic changes on mitral valve were observed in 117 (34.0%) patients, and this was a limitation for valve preservation surgeries.

Within the last 30 years, surgery methods have been noticeably changed. For this reason, the description of the last decade developments are mentioned. The surgeries were carried out in artificial blood circulation conditions, moderate hypothermia ($27 - 32$ C) with cold crystalloid cardioplegia (mostly Custodiol). Aorta compression time was 93.2 ± 18.2 min. and artificial blood circulation time was 133.2 ± 21.5 min.

Values	I degree of LA massive thrombosis	II degree of LA massive thrombosis	III degree of LA massive thrombosis	p
Quantity	33	102	209	
Mitral stenosis duration (years)	13.4±3.7	17.8±3.1	21.5±4.3	< 0.05
Atrium fibrillation (years)	2.1±0.6	3.5±0.8	5.2±0.6	< 0.05
M/W (%)	15/18	46/56	81/128	< 0.05
Age (years)	43.2±5.7	53.4±6.1	61.1±0.7	< 0.05
NYHA IV (%)	45.4	63.7	92.8	< 0.05
Preoperative thromboembolic complication (%)	18.2	21.6	24.4	< 0.05
Previous surgeries (%)	6.1 (2)	26.5 (27)	34.9 (73)	< 0.05

Mitral valve replacement was made in the majority of cases – 301 (87.5%) due to its noticeable deformation (calcification and rough fibrosis). Valve reconstruction (open mitral commissurotomy) was performed only in 43 (12.5%) cases.

Assistent tricuspid disease was corrected as well (n = 68 – 19.7%). The patients were divided in 2 groups depending on correction type of tricuspid valve: 1) mitral valve replacement and tricuspid valve annuloplasty according to N. Amosov due to its functional insufficiency – 57 (83.8% in all cases of tricuspid disease); open mitral commissurotomy and tricuspid valve annuloplasty according to N. Amosov due to its functional insufficiency – 3 (4.4%); 2) mitral valve correction, commissurotomy and tricuspid valve annuloplasty according to N. Amosov due to its organic lesion – 7 (10.3%) patients, open mitral commissurotomy and tricuspid valve annuloplasty according to N. Amosov due to its organic lesion – 1 (1.5%) patient.

301 mitral prosthesis of the following types were installed: MKCh–25 – 12 (4.0%), MKCh–27 – 13 (4.3%), biologic prosthesis 3 (1.0%), monodisc (EMIKS, LIKS, MIKS, ALCARBON, ELMAK) – 83 (27.6%), bicuspid (Saint Jude, ON–X, Edwards–MIRA, Carbomedics) – 190 (63.1% of patients). Cox maze procedure was carried out in 15 (4.4%) cases due to constant atrium fibrillation. When left atrium dilation was present (more than 60 mm is a marker of atriomegaly), left atrium posterior wall plasty was made in 25 (7.3%) patients, 20 (5.8%) among them with Kawazoe method and 5 (1.5%) with left atrium triangular plasty original method.

Assistent ischemic heart disease was observed in 39 (11.3%) patients in the average age of 57.1 ± 4.7 , in 9 (2.6%) patients there was venal aortal coronary bypass installed: 1 coronary artery bypass (6 patients), 2 coronary artery bypass (3 patients). High blood pressure of 1 – 2 degree was observed in 57 (16.5%) patients.

In case of mitral valve moderate fibrosis and single small calcium inclusions, there was a reconstruction performed in a form of open mitral commissurotomy in 43 (12.5%) patients, in 4 (9.3%) of them it was followed by Reed commissurotomy.

Optimally, when massive thrombosis of left atrium is present, thrombotic mass was eliminated together with its matrix base (1 – 9). This procedure has a principal meaning, because the remaining rough surface on left atrium wall leads to thrombotic mass deposit relapse on it in early and long-term postoperative period, which in turn leads to thromboembolic complications.

During each surgery the endeavors were made to remove all thrombotic mass as well as the thrombus base, which usually was a well formed connective tissue with dense adherence to atrium wall. Base was removed together with subiculum, and the remaining surface looked a little bit uneven and rough. Fibrin strands were left, which had to be additionally removed by a swab. The area between atrium wall and thrombus was made wider step by step, reaching to other pulmonary vein entrances and mitral valve fibrotic ring. As a rule, calcification of thrombus inner layers (7 cases) was not an obstacle for thrombus mobilization. There were significant difficulties, however, during thrombus detachment from calcinated atrium wall.

Removal of thrombotic mass together with matrix base is considered a radical method, while removal of throm-

botic mass only and keeping of matrix base is considered a partial method. Radical method was used in 138 (45.8% – n = 138/301) patients and partial one – in 163 (54.2% – n = 163/301) during mitral valve replacement. Radical method was used in 23 (53.5% – n = 23/43) patients and partial one – in 20 (46.5% – n = 20/43) patients during open mitral commissurotomy. Left atrium chamber was washed with 0.5 liter of normal saline after all thrombotic mass removal, covering left atrioventricular opening with gauze wipe. After that, left atrium thorough visual inspection was carried out. Same inspection and also of left ventricular chamber was made after mitral valve leaflet division or excision.

Radical methods division of left atrium mitral thrombosis (matrix base) removal according to left atrium mitral thrombosis degree is shown in *Table 2*.

According to *Table 2*, the possibility of thrombotic mass radical removal proportionally decreases at thrombotic mass deposit increase.

There is a danger of left atrium wall bursting during thrombotic mass radical removal, which was observed in 7 (2.0% – n = 7/344) patients. All bursting events were observed in patients with III degree of left atrium mitral thrombosis 3.3% (n = 7/209). None of the cases resulted in cause of death. Mitral valve replacement was done in 6 cases and open mitral commissurotomy in 1 case. Autopericardiac patch was used in burst area in 3 cases. Usual suture was performed in 4 other cases.

Left atrium appendage manipulations are the second important element of thromboembolic complication cause removal and thromboembolic threats in general. The reason is that appendage ligation (inside suture or outside tie) is an obligatory component of left atrium mitral thrombosis surgical treatment in patients with left atrium mitral thrombosis and predisposition to thrombus formation as the most important pathology element (1,5,8,9). Appendage was ligated in 161 (46.8%) patients. Appendage internal suture was performed in 107 (66.5% – in ligated appendages) patients, outside tie – in 44 (33.5%). Left atrium appendage was ligated after previous mitral valve surgery, which was closed mitral commissurotomy, in 104 patients. Thus, left atrium appendage was ligated in 256 (74.4%) patients.

Nevertheless, if a combination of matrix base/appendage (2 main factors of thrombus formation) was considered, the following variants of thrombotic mass and following deposit preventive measures were observed: variant 1 – thrombotic base radical removal and left atrium appendage ligation –

Table 2. Radical methods division of left atrium mitral thrombosis removal according to its degree

Left atrium mitral thrombosis degree	Radical removal	Spec. gravity (%)	P
I (n=33)	26	78.7	< 0.05
II (n= 102)	49	48.8	< 0.05
III (n= 209)	70	33.5	< 0.05
Total	145	42.2	

According to *Table 2*, the possibility of thrombotic mass radical removal proportionally decreases at thrombotic mass deposit increase.

Table 3. Variant division of base removal and left atrium appendage ligation according to left atrium mitral thrombosis degree

	Variant 1 (thrombotic base radical removal and LA appendage ligation)	Variant 2 (thrombotic base radical removal and LA appendage intact)	Variant 3 (thrombotic base partial removal and LA appendage ligation)	Variant 4 (thrombotic base partial removal and LA appendage intact)
I degree of LA mitral thrombosis (n = 33)	26	1	5	1
Spec. gravity (%)	78.8	3.0	15.2	3.0
II degree of LA mitral thrombosis (n = 102)	49	1	28	24
Spec. gravity (%)	48.0	1.0	27.5	23.5
III degree of LA mitral thrombosis (n = 209)	70	14	78	47
Spec. gravity (%)	33.4	6.7	37.3	22.6
Total	145	16	111	72

According to Table 3, radical correction variant 1 was used by I degree of left atrium mitral thrombosis in 78.8% cases, II degree - in 48.0% cases and by III degree - in 33.4% cases (p < 0.05). This proves inverse relevance between the possibility decrease of thrombotic mass radical removal and left atrium thrombotic mass deposit degree. The same trend was observed in all other 3 variants.

Table 4. Specific gravity of lethal thromboembolic complications (all) depending on prevention measures methods (base removal/left atrium appendage ligation) regarding the degree of LA mitral thrombosis during mitral valve replacement

	Variant 1 (thrombotic base radical removal and LA appendage ligation)	Variant 2 (thrombotic base radical removal and LA appendage intact)	Variant 3 (thrombotic base partial removal and LA appendage ligation)	Variant 4 (thrombotic base partial removal and LA appendage intact)
I degree of LA mitral thrombosis (n = 22)	18/0	0/0	3/0	1/0
Thrombosis complication frequency (%)	0.0	0.0	0.0	0.0
II degree of LA mitral thrombosis (n = 86)	42/1	1/1	23/0	20/1
Thrombosis complication frequency (%)	2.4	100.0	0.0	5.0
III degree of LA mitral thrombosis (n = 193)	64/1	13/0	74/7	42/2
Thrombosis complication frequency (%)	1.6	0.0	9.5	4.7
Total	124/2	14/1	100/7	63/3
Frequency (%)	1.6	7.1	7.0	4.8%

(n/n) - quantity of patients, who underwent surgery / quantity of patients, who died among them.

43.4% (n = 145/344), variant 2 – thrombotic base radical removal and left atrium appendage intact – 4.8% (n = 16/344), variant 3 – thrombotic base partial removal and left atrium appendage ligation – 33.2% (n = 111/344) and variant 4 – thrombotic base partial removal and left atrium appendage intact – 21.6% (n = 72/344).

Variant division of base removal and left atrium appendage ligation according to left atrium mitral thrombosis degree is shown in *Table 3*.

According to *Table 3*, radical correction variant 1 was used by I degree of left atrium mitral thrombosis in 78.8% cases, II degree – in 48.0% cases and by III degree – in 33.4% cases (p < 0.05). This proves inverse relevance between the possibility decrease of thrombotic mass radical removal and left atrium thrombotic mass deposit degree. The same trend was observed in all other 3 variants.

Results

Hospital mortality was 4.2% for mitral valve replacement and 0.0% for open mitral commissurotomy during the period of 2000 – 2014. The causes of death were acute cardiovascular insufficiency (n = 4), central nervous system damage (thromboembolia) (n = 3), bleeding (n = 4) and multi-organ insufficiency (1) within this period. Hospital mortality depended on the degree of left atrium mitral thrombosis: I degree – 0%, II – 3.9% and III – 5.1% (p < 0.05).

A direct dependence proportion was observed between hospital mortality (all) and left atrium mitral thrombosis degree within the whole period of research: I degree of left atrium mitral thrombosis – 0.0% (n = 0/22), II degree – 3.5% (n = 3/86) and III degree – 5.2% (n = 10/193) (p < 0.05).

Variant division of thromboembolic complication preventive measures (base removal / left atrium appendage

ligation) is shown in Table 4, depending on the degree of left atrium mitral valve thrombosis after mitral valve replacement for all cases of thrombotic complications (total).

According to the data from *Table 4*, only a complete follow-up of all procedures for thrombotic mass removal (matrix base) as well as the source of possible thrombotic complications (appendage) in group 1 allows getting statistically the most insignificant level of hospital mortality due to thrombotic complications in variant 1. It is necessary to underline a low level of thrombotic complications at III degree of left atrium mitral thrombosis in variants 1 and 2 (base complete removal): 1.6% (n = 1/64) and 0% (n = 0/13) (p < 0.05). After open mitral commissurotomy, hospital mortality was observed only in variant 3 with 18.2% (n = 2/11) (p < 0.05) despite appendage ligation due to thrombotic complications. This proves the advisability of thrombotic matrix base removal.

Hospital mortality depended on the presence of previous closed mitral commissurotomy: 5.7 % of mortality in the group with previous closed mitral commissurotomy and 2.5 % without it (p < 0.05). Hospital mortality depended on calcinosis +3 on mitral valve: 8.2% mortality in the group with mitral valve calcification +3 and 2.1% mortality in the group without calcinosis +3 (p < 0.05). Donated blood and its components were not used in 27 (7.8%) patients within the whole hospital period. Correct rhythm for release was observed only in 15 (4.5%) patients, 12 from them were after Cox maze surgery [10]. Apart from indirect anticoagulants, patients were prescribed antiaggregants from day 5 [10].

Discussion

Many authors didn't focus their attention on deletion of maternal basement of thrombotic masses in cases with massive thromboses of left atrium. The next step of optimum result of correction is ligation of left atrium's auriculum, especially in presence of atrium fibrillation. It's the necessary concomitant procedure. Maze procedure must be performed in all such cases. This is the key to the optimum results at the hospital period. At the hospital period with indirect anticoagulate drugs (varfarin) must be used antiagrigate drugs (aspirin, clopydogrel) for reduction of level of thrombotic events especially in cases this mitral mechanical valve.

Conclusions

During the surgery in patients with left atrium mitral thrombosis, it is important to remove the matrix base and tie left atrium appendage, which significantly lower the risk of hospital mortality and thromboembolic complications within hospital period. Suggested classification variant of left atrium mitral thrombosis allows clearly distinguishing the state severeness degree of patients, who underwent surgery, and possibility of thrombotic complication development. CT-scan of head and abdomen organs is a must in order to exclude unnoticed events of thromboembolia before surgery. Cox maze procedure is a suggested element of a surgery. Thorough antiaggregant therapy is a very important part of thrombosis complication prevention measures.

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