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**Long-term results and re-interventions after the Ross procedure**

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Treatment of patients of different age groups with congenital aortic valve (AV) pathology is still one of the topical problem of cardiac surgery. There are great number of different surgical techniques of repair of AV which demonstrate the complexity of restoration the competent valve.

137 patients underwent Ross procedure in UCCC during period from 2004 to 2014. Immediate and long-term results were evaluated. The overall postoperative mortality rate was 3.6% (5 patients). The long-term survival reached 99.3%. Freedom from reoperation on pulmonary artery conduit (PA) after 10 years was 87%, freedom from balloon dilatation of PA conduit after 10years was 81%. Freedom from reoperation on autograft in this group of patients reached 99.2%. Our work demonstrates good immediate and long-term outcomes after Ross procedure. **Keywords:** Ross procedure, aortic valve, autograft, conduit.

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**Introduction.** Congenital abnormalities of the aortic valve (AV) account for 5-15% of all congenital heart defects [1]. AV pathology occupies 15% of all valves diseases and is the second in prevalence after mitral valve defects. The relatively high frequency of congenital and acquired pathology of the AV and aortic root necessitates continuous selection of the best options for surgical correction as well as their optimization [2,3].

The search for the ideal replacement option of the AV has led the British cardiac surgeon Donald Ross to develop a method of reimplantation of pulmonary autograft in subcoronary position in 1960[4]. Pulmonary autograft in the aortic position provides good hemodynamic performance. It grows with the child, and is silent, resistant to infection and has minimal risk of thromboembolic complications and hemolysis, There is no need for taking anticoagulants [5,6]. But there is still an issue about longevity of this procedure in the pediatric group of patients [3]. The analysis of current publications allows to conclude that the immediate results of Ross operation are quite satisfying, but long-term results in patients of different age groups remain poorly studied.

**Objective:** To analyze the long-term results and reintervention rate after Ross procedure for the period from 2004 to 2014y.

**Material and Methods:** Between 2004y and 2014y Ross procedure was performed in 137 patients in "UCCC". Patient’s age varied from 1 month to 38y. (116,3 ± 85mon.), body weight - from 3kg to 98kg (35,9 ± 22,1kg). Indications for surgery were: combined AV pathology with prevalence of stenosis in 72 (52.6%) patients, systolic gradient at AV ranged from 60 to 170 mmHg (85,5 ± 26,2mmHg), with AV insufficiency from mild to moderate, combined AV pathology with prevalence of insufficiency at least more than moderate in 45 (32.7%), systolic gradient in these patients ranged from 6 to 60 mmHg (35,7 ± 8,6 mmHg) and AV pathology without prevalence in 20 (14.7%) patients with less than moderate aortic insufficiency and systolic gradient of 25 to 65 mmHg (30 ± 9,7 mmHg). 62 patients (42%) had previous surgeries or interventions, including: balloon dilatation of AV - 35 (25.5%), AV repair - 12 (8.8%), subaortic stenosis repair - 6 (4.4%), coarctation repair - 6 (4.4%), ventricular septal defect closure - 3 (2.2%). The pulmonary valve was replaced with the following types of conduit: Gore-Tex tube with three handmade Gore-Tex cusps in 56 (40.6%) patients, dacron tube with three handmade Gore-Tex cusps in 28 (20,4%), Edwards bioprosthesis in 32 (23.7%), homograft in 1 (0.7%), tricuspid pericardial autograft 5 (3.6%), monocuspid pericardial autograft in 2 (1.5%), direct pulmonary artery reconstruction with monocusp without tube interposition in 13 (9.5%). The diameter of the conduit in pulmonary artery (PA) position varied from 12 to 32 mm, (23,8mm ± 4 mm). Long term follow-up ranged from 2mon. to 126 mon., ( 45mon ±30mon).

The examinations after surgery included electrocardiography, echocardiography, heart catheterization, magnetic resonance imaging. Mortality rate and number and reasons of reoperations were studied.

**Results:** Of the 137 patients we operated on 4 patients (2.9%) died in the early postoperative period. 133 patients (97.1%) were discharged in a good condition. Long-term follow up was complete in 129 (97%) patients. 4 patients were lost. 2,5 years old child (0.78%) died 29 months after procedure, the cause of death was fungal sepsis.

13,3% of patients (n = 17), required reoperations during follow up, the main reason was PA conduit stenosis with maximum pressure gradient ranged from 50 to 80 mmHg (65,5 ± 9,3mmHg). 13 patients (10.2%) had balloon dilatation of conduit stenosis before reoperation without significant effect and further needed surgery. In addition, another 12 (9.3%) patients underwent balloon dilatation of conduit stenosis with a satisfactory result (the peak pulmonary artery gradient from 32 to 63mmHg, average 49,4 ± 9,9mmHg). A total of 24 interventions (18.8%) performed in patients after Ross operation. Freedom from reoperation on PA conduit was 87% at 10 y., freedom from balloon dilatation of PA conduit stenosis at 10 y. was 81%. Table 1 shows the distribution of interventions and reoperations depending on the type of conduit.

Table 1.

Interventions and surgeries for conduit LA

|  |  |  |
| --- | --- | --- |
| Type of conduit | Balloon dilatation of conduit | Conduit reoperation |
| Gore-Tex tube with three handmade Gore-Tex cusps | 16 (67%) | 11 (64%) |
| dacron tube | 1 (4%) | 1 (6%) |
| Edwards bioprosthesis | 6 (25%) | 3 (18%) |
| Homograft | - | - |
| Tricuspid pericardial autograft | - | 2 (12%) |
| Monocuspid pericardial autograft | 1 (4%) | - |
| Direct PA reconstruction with monocusp | - | - |
| Total | 24 (100%) | 17 (100%) |

1 patient (0.8%) required surgery on autograft because of severe insufficiency. AV repair was performed in this case with satisfactory result. Freedom from reoperation on autograft at 10y was 99.2%. However, during the period of observation on autograft dysfunction due to severe failure in 3 patients was made to replace the AV prosthesis, including one patient was performed Bentall operation. Ross procedure in these patients was performed in 1996 in 2 and one in 1997. And replacement autograft on artificial prosthesis held on average 16,5years after surgery.

**Conclusions:**

1. Ross procedure is a technically demanding procedure with good immediate results and low mortality at long-term postoperative period.

2. Freedom from reoperations on autograft during the first decade of life was 99.2%.

3. Freedom from reoperation on PA conduit at 10 y. was 87%, freedom from balloon dilatation of PA conduit stenosis was 81%, so the optimal substitute for PA valve is not currently defined.

4. Endovascular interventions give a satisfactory results and allow to delay the surgical replacement of PA conduit approximately in 50% of cases.

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