UDC 616-072.7 616.12-089 616-08-059

**Complex radial diagnostics of hemodynamic changes in long term period after Ross procedure**

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            Resume. Echocardiographic diagnosis can effectively assess the immediate and long term results after Ross operation and find the causes of reinterventions.

         The complex radial diagnostics was performed in 174 of 200 patients who had Ross procedure during the period from 1996 to 2002 in Institute of Cardiovascular Surgery of the Academy of Medical Sciences of Ukraine and from 2003 to 2015 in UCCC .

With Echocardiography method used for evaluation of immediate and long-term results.

 Overall postoperative mortality was 8.9% (17 patients). Freedom from RV-PA conduit reoperation after 15 was 85.1%, freedom from balloon angioplasty of RV-PA conduit afer 15 was 86.7%. Fifteen-year freedom from reoperation on autograft in this group of patients has reached 95.6%. Our research proves good immediate and satisfactory long-term results of Ross procedure.

**Keywords:** Ross procedure, aortic valve autograft, conduit.

Implantation of pulmonary autograft - replacement of aortic valve with native pulmonary valve is an effective method of surgical treatment of aortic valve defects in children and adults (1). Thanks to the improvement of surgical techniques and the use of new modifications operational risk of this technically challenging procedure has decreased significantly and today is 1,5-5%, the number of postoperative complications has also decreased significantly over the past decade. The advantages of this operation in comparison with mechanical valve is that there is no need for anticoagulant therapy, and the most important fact is that pulmonary autograft is capable of growing, which is an important advantage of the Ross procedure. (2,3,4). But in long-term follow-up period, since the second decade pulmonary autograft and neopulmonary artery demonstrate limited functionality, reoperations and interventions on neopulmonary valve and right ventricular outflow tract (RVOT) are major complications of this operation. (5.6). We studied our own experience of pulmonary autograft surgery in aspect of functional longevity of neoartic and neopulmonary valves.

           **Purpose:** to implement echocardiographic assessment of long-term results and causes of repeated interventions after the Ross procedure for twenty-year period.

  **Material and Methods:** During the period from 1996 to 2002 in ICVS AMS Ukraine and from 2003 to 2015 in UCCC Ross procedure was performed in 200 patients . Including male patients 78% (156) and female - 22%(44). The age of patients was 145±101,6months (1month-54years.), 24% (n=48)of them -in the age of 5 years, 18% (n=36) - from 6 to 10 years, 30% (n=59 ) -from 11 to 15 years, 28% (n=57) over 16 years. Average weight – 40,2±22,7kg (from 3kg to 198kg). Echocardiographic indications for surgery were: combined aortic valve defect with stenotic component predominance in 103 (51.5%) patients, systolic gradient AV was 84.5 ± 26,2mm Hg (from 58 to 172 mm Hg), with average insufficiency 0,5+ (0 to 2,5+). Combined aortic valve defect with insufficiency predominance - in 68 (34%), average reverse flow on AV - 3+ (from 2,5 to 4+), systolic gradient - 32,5 ± 8,2mm Hg (6 to 50 mm Hg). Combined aortic valve without predominance - in 29 (14.5%) patients, aortic insufficiency was 0.5 to 2,5+ (on average 1,5+), systolic gradient - ± 32 9,7mm Hg (from 22 to 63mm Hg).

Previous surgery: 112 operations performed in 93(46.5%) patients. In 45 patients (22.5%) - with the use of cardiopulmonary bypass, 9 (4.5%) - without the use of cardiopulmonary bypass. Aortic valve balloon valvuloplasty has been performed in 55 patients (27.5%). For RVOT reconstruction the following types of conduits were used: Gore-Tex vascular prothesis with handmade threecuspid valve mechanism made of Gore-Tex membrane - in 54 (27%) patients, Vascutec - 33 (16,5%), Edwards - in 32 (16%), homohraft - in 18 (9%), threecuspid autograft of autopericardium -in 43 (21,5%), pulmonary artery forming from remnant tissue with unicuspid valve mechanism - in 16 (8%), autopericardium made conduit with threecuspid valve mechanism made from the Matrix membrane 4 (2%). The diameter of conduit placed in pulmonary position ranged from 12 to 32 mm, medium - 23,9mm ± 4,2mm.

Long-term observation period was 96mis ± 67months. (From 3 to 240months).

            Complex of studies long-term postoperative period included echocardiography using consistent measurements and calculations in B - mode, M - mode, continuous, pulse and color Doppler. Research of long-term results included frequency of lethal cases, causes of reoperations on autograft and RVOT.

**Results:** Of the 200 of operated patients in the early postoperative period, 12 deaths (6%) patients. In long-term period 5 deaths (2.9%) patients. Total mortality was in 17 patients (8.9%). 188 (94%) patients discharged in satisfactory condition. Long-term results tracked in 174 (92.4%) patients. Lost observation in 14 patients.

           In long-term period 10 autograft reoperations in 9 patients were performed. Indications for reoperation on echocardiography data in most patients were: severe neoaortic valve insufficiency with root and ascending aorta dilatation, one patient had mild aortic valve insufficiency with subaortic stenosis, which also required surgery. The average period before surgical reintervention on autograft after Ross procedure was 154,3months (12 to 212months). In these patients the following surgical procedures were performed: Bentall operation in 5 patients, 2 patients had aortic valve replacement(mechanic), in 1 patient - AVR + ascending aorta replacement, one Yacoub operation, but in 24 months this patient undergone aortic valve replacement due to the severe aortic insufficiency. Freedom from reoperation on autograft was - 99.5%, 98.3%, 95.6% after 5, 10 and 15 years. Frequency rate of reoperations on RV-PA conduit in long-term period was 14,7% (n = 27), median time before conduit replacement was 64months (12 to 212month). The main reason for the reinterventions was severe conduit stenosis, maximum pressure gradient onconduit was 65.5 ± 9,3mm Hg(50 to 80mm Hg). Before conduit reoperation 13 patients (7%) underwent balloon dilatation, but without satisfactory efect and further surgical resolution. In addition, another 14 (7.6%) patients underwent balloon dilatation of stenotic conduit with satisfactory result, which required no reinterventions.

The maximum pressure gradient on conduit in the latter group of patients is 48.5 ± 9,6mm Hg (35 to 60mm Hg). Total amount of angiographic procedures after Ross was 27 (14.7%). Freedom from reoperations on RVOT - 91.8%, 87.4%, 85.1% after 5, 10 and 15 years. Freedom from reinterventions on RVOT was 88.3%, 86.7% at 5 and 10 years. Freedom from any heart surgery after Ross was 81.4%, 72.6%, 67.2% after 5, 10 and 15 years.

**Conclusions:**

1. Complex radial diagnostics are effective in operation outcome evaluation and identify the causes and indications for reinterventions.
2. According to the echocardiographic study data patients have good short term and satisfactory long-term results, so there is need for detailed assessment in long term follow-up and search for more advanced diagnostic methods in future.
3. Improvement echocardiographic examination should be directed also to assess the RVOT and right ventricular function. Freedom from reoperation on RVOT was 85.1% of reiterventions was - 86.7%
4. Fifteen-year freedom from reoperation on autograft was 95.6%.

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