

## IMMEDIATE RESULTS OF SURGICAL CORRECTION OF ABNORMAL CONFLUENCE OF PULMONARY VEINS

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**Annotation:** The article presents the materials of operated patients with abnormal pulmonary drainage for the period from 2001 to 2021 in the Department of Surgery for congenital heart defects of the Academician V.Vakhidov Russian National Heart Hospital, the age of patients was 1-45 years. Surgical correction of the defect was performed from median sternotomy and right lateral thoracotomy, under conditions of artificial circulation. The analysis of the features of the course of the immediate postoperative period, depending on the type of defect. The dynamics of anatomical and functional parameters of operated patients with abnormal pulmonary vein drainage were studied. Changes in heart parameters were analyzed using electrocardiography, echocardiography and radiography.

**Keywords:** congenital heart disease, abnormal pulmonary vein drainage, pulmonary hypertension, evaluation of results.

The relevance of the problem. Abnormal pulmonary vein drainage (APVD) is a rare congenital defect, according to various authors, it accounts for 1.5–2% of all congenital heart defects (CHD) [2,5,9,16]. Currently, two variants of this anomaly are distinguished: partial abnormal pulmonary vein drainage (PAPVD) – one or more (but not all) pulmonary veins drain from the left atrium and total abnormal pulmonary vein drainage (TAPVD), in which blood from all pulmonary veins enters the right atrium or vena cava [2,4,8,15,17]. APVD is often associated with atrial septal defect (ASD).

Introduction. Due to the variety of anatomical forms of APVD, several options for surgical correction have been proposed [1,4,9,14,16,18]. The reversibility of a number of malformation symptoms after surgical treatment has been the subject of serious study by a number of researchers. It should be noted that there are few reports of changes in hemodynamics in the immediate period after APVD correction, most hemodynamic parameters contain information about any one function of the heart, and studies of the functional ability of the heart in patients with APVD are poorly described in the literature [1,4,7,9,19]. This determines the need to evaluate a whole range of values, the analysis of which provides an objective picture of the state of hemodynamics and pumping function of the heart in the process of adaptation of the myocardium to new circulatory conditions. In this regard, the study of the results of the APVD

operation is undoubtedly relevant and of scientific and practical interest.

The purpose of the study: to study the results of surgical treatment of abnormal ownership of pulmonary veins in conditions of artificial circulation.

In the Department of Surgery of the CHD of the State Medical University of the Russian Academy of Medical Sciences. Academician V.Vakhidov and in the Department of Cardiac Surgery of the ASMI from 2001 to 2021, 267 patients were observed for APVD. 46 (17.2%) patients were not operated on for various reasons. Surgical correction of the defect was performed in 221 (82.7%) patients; most of them underwent surgery at the Russian Academy of Medical Sciences. Academician V.Vakhidov (Figure 1).

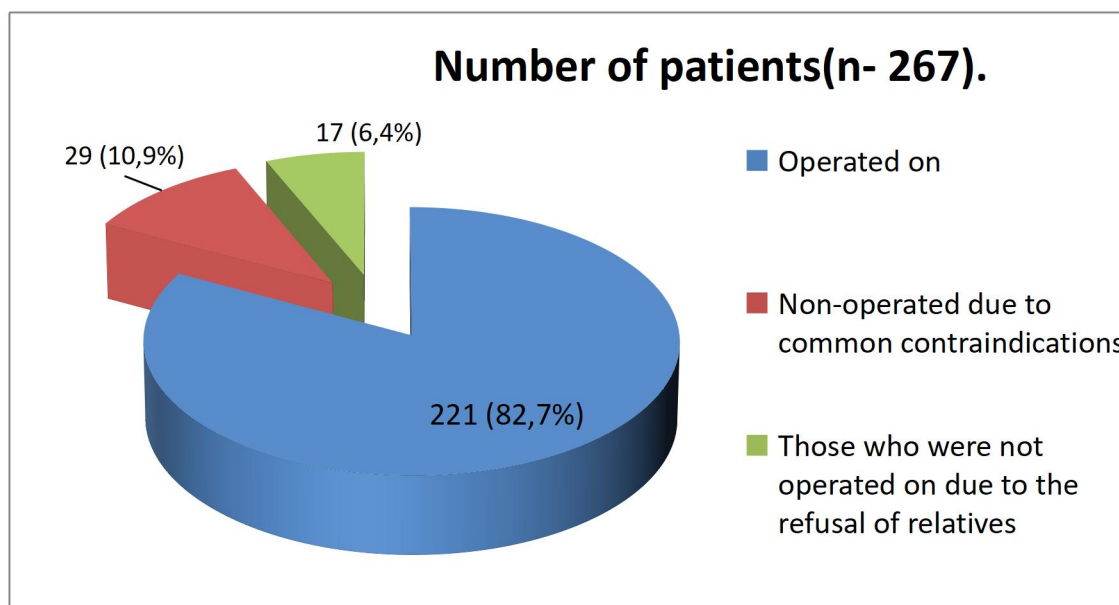


Fig. 1. Distribution scheme of patients with APVD

Among the operated patients with APVD - 109 (49.3%) were men, 112 (50.7%) were women. The age of the patients ranged from 1 month to 45 years, averaging  $13.3 \pm 0.26$  years.

Surgical correction of APVD was performed in 221 patients with various anatomical variants. Surgical tactics and the volume of surgical interventions performed in APVD depended on the form of the defect. The nature and level of PV drainage, as well as the presence of a concomitant defect, were of great importance when choosing a particular method for correcting a defect and ensuring it. In all cases, the correction of the defect included dislocation of the PV mouth into the left atrium with a patch, through ASD with simultaneous ASD plastic surgery, as well as the elimination of concomitant heart defects.

In all cases, the correction of the defect was carried out with artificial blood circulation. As a rule,

129 (86.5%) open-heart surgeries were performed through median sternotomy, and in 20 (13.5%) cases, right lateral thoracotomy was used. Cannulation of the aorta and vena cava was performed according to a standard protocol: in 83 cases where there was type I PAPVD in the VCS, the latter was cannulated with an "L"-shaped cannula above the confluence of the pulmonary veins. All patients were taken to the intensive care unit after adequate correction of the defect.

Thus, in the intensive care unit, after stabilization of hemodynamics and acid-base status, these patients were extubated within 4-12 (on average  $6.1 \pm 0.17$ ) hours after correction of the defect. In the preoperative period, 25 (11.3%) patients had cyanosis of the skin, which disappeared immediately after surgery. Auscultationally, the preoperative noise pattern disappeared in all patients of this group. All hemodynamic parameters stabilized during the first 2-3 days after adequate correction of the defect. However, the absence of a characteristic defect noise after surgery does not give reason to think about a complete normalization of hemodynamics.

Thus, 52 (23.5%) patients, despite the absence of noise, still had a II-tone accent over PA, which is an indirect sign of PH. Of this group of patients, 12 (5.4%) patients had mild heart failure (shortness of breath, enlarged liver, increased, visible pulsation of the neck vessels, etc.), lability of blood pressure and pulse rate (tendency to tachycardia, various cardiac arrhythmias). The above-mentioned signs of hemodynamic disorders after minimal drug therapy (cardiotonics, hormones, vitamins, electrolyte balance correction, etc.) were eliminated within 1 day after surgery.

In the immediate postoperative period, 10 (4.5%) patients showed a satisfactory result (Table 1). In all these patients, the general condition in the postoperative period was of moderate severity, cyanosis of the skin in patients with TAPVD disappeared, and there were noticeable signs of hemodynamic disorders and heart disease.

So, in 5 (2.2%) patients, a weak systolic murmur was heard in the II-III intercostal space to the left of the sternum. All patients had an accent and splitting of the II tone over LA. These signs were present in those patients who had grade II and III PH before surgery. Signs of heart failure (shortness of breath, palpitations, enlarged liver, high central venous pressure and increased pulsation of the cervical vessels), lability of blood pressure and pulse were observed in all patients of this group. After adequate enhanced drug therapy, these signs disappeared within 2-4 days after surgery. It should be noted that the patients in this group were operated at the age of over 18 years and, naturally, had a high degree of PH (Grade II and III).

An unsatisfactory (poor) result of surgery in the immediate postoperative period was noted in 13 (5.9%) patients (Table. 1) with TAPVD. In these patients, the general condition progressively worsened in the immediate postoperative period, signs of heart failure increased (shortness of breath, palpitations, liver enlargement), central venous pressure increased and cystic acidosis worsened. Despite intensive drug therapy, the patients' condition progressively worsened and death occurred within 1-9 (on average  $4.2 \pm 0.84$ ) days.

Table 1.

Clinical assessment of patients with APVD before and after surgery

| CLINICAL CHARACTERISTICS  |            |                      | TYPE OF APVD |             | In total    |
|---------------------------|------------|----------------------|--------------|-------------|-------------|
|                           |            |                      | PAPVD        | TAPVD       |             |
| Circulatory insufficiency | I degree   | before the operation | 40 (18,09%)  | 10 (4,5%)   | 50 (22,5%)  |
|                           |            | after the operation  | 11 (4,9%)    | 5 (2,2%)    | 16 (7,1%)   |
|                           | II degree  | before the operation | 101 (45,7%)  | 51 (23,07%) | 152 (68,7%) |
|                           |            | after the operation  | 1 (0,4%)     | 2 (0,8%)    | 3 (1,2%)    |
|                           | III degree | before the operation | 8 (3,6%)     | 11 (4,9%)   | 19 (8,5%)   |
|                           |            | after the operation  | -            | 13 (5,9%)   | 13 (5,8%)   |

Postoperative complications, depending on the time of occurrence, can be roughly divided into early and late. Early postoperative complications occurring in the first hours and days after surgery were noted in 42 (19.0%) patients. The nature and number of these complications are shown in Tables 2 and 3.

Table 2

Early postoperative complications in patients with APVD

| The nature of the complication | Type of vice |         | In total |
|--------------------------------|--------------|---------|----------|
|                                | PAPVD        | TAPVD   |          |
| Arrhythmias                    | 8(3,6%)      | 4(1,8%) | 12(5,4%) |
| Postoperative Bleeding         | -            | 1(0,4%) | 1(0,4%)  |

|                        |           |           |           |
|------------------------|-----------|-----------|-----------|
| Heart failure          | 11(4,9%)  | 7(3,1%)   | 18(8,1%)  |
| Bacterial endocarditis | 1(0,4%)   | -         | 1(0,4%)   |
| Shock lung             | 1(0,4%)   | -         | 1(0,4%)   |
| Pneumonia              | 5(2,26%)  | 4(1,8%)   | 9(4,07%)  |
| Total                  | 26(11,7%) | 16 (7,2%) | 42(13,1%) |

Late postoperative complications of the hospital period were noted in 19 (8.6%) patients (Table 3): 3 (1.36%) patients had exudative pleurisy, 4 (1.8%) patients had late suppuration of the wound with the development of mediastinitis, and 1 (0.4%) patient had partial suppuration of the wound with the formation of a ligature fistula. All these patients in the department received appropriate treatment and procedures, and as a result, these patients were discharged home in satisfactory condition.

Table 3.

Late postoperative complications in patients with APVD.

| The nature of the complication                            | Type of vice |           | Total     |
|-----------------------------------------------------------|--------------|-----------|-----------|
|                                                           | PAPVD        | T APVD    |           |
| Exudative<br>Pleurisy                                     | 1 (0,4%)     | 3 (1,3%)  | 4 (1,7%)  |
| Mediastinit                                               | 1 (0,4%.)    | 3 (1,3%)  | 4 (6,52)  |
| Partial suppuration of a wound with a<br>ligature fistula | 4 (1,7%)     | 7 (3,1%)  | 11 (4,9%) |
| Total                                                     | 6 (2,7% )    | 13 (5,8%) | 19 (8,5%) |

Hospital mortality was 5.9% (13/221). It should be noted that fatal outcomes were observed after correction of TAPVD (Fig. 2); this indicator over the past years has been minimized in recent operations with APVD. When clarifying the causes of the unfavorable outcome, it turned out that the mortality was not always due to errors in operational technology.

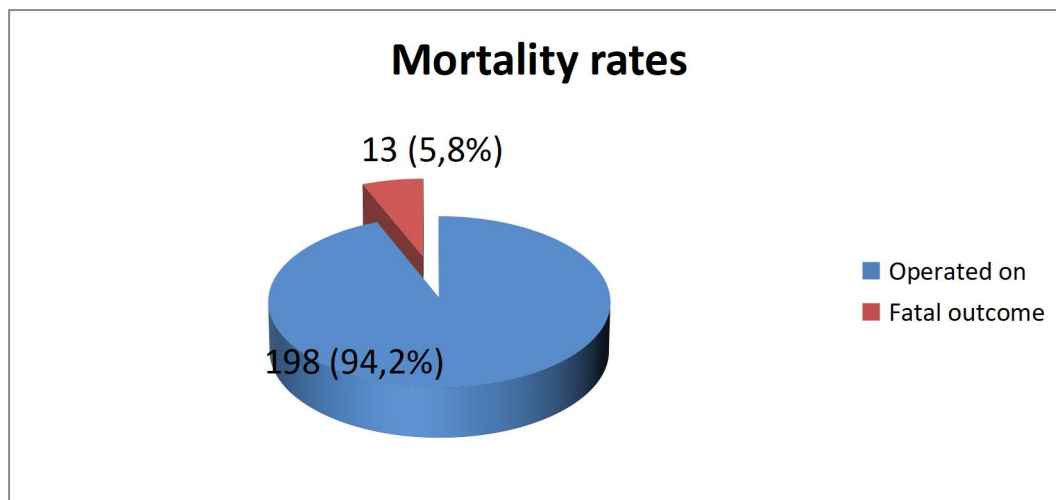


Figure 2. Mortality rates.

In our observation, it turned out that the outcomes of surgery in patients with TAPVD largely depend on the age and initial severity of the sick children. Thus, mortality was observed in those who underwent surgery in early childhood and in children with high pulmonary hypertension.

Discussion and conclusion. Thus, in our observations, the following immediate results of surgery after correction of APVD were noted: 198 (89.6%) have good, 10 (4.6%) have satisfactory and 13 (5.8%) have unsatisfactory. In the immediate postoperative period, all patients showed an improvement in anatomical and functional parameters, according to ultrasound, ECG and X-ray studies. According to electrophysiological research methods, it was found that in the immediate postoperative period, arrhythmias occur in 6.5% of the operated patients. According to V.S.Sergievsy [8,], rhythm disturbances after surgery were observed in 10.3% of cases. Moreover, this happens 2.5 times more often in adults than in children. The authors noted that these arrhythmias are difficult to treat and worsen long-term outcomes [10,11,13].

X-ray examination methods revealed that hypervolemia in the small circle of blood circulation decreases in almost all patients, and the size of the heart normalizes. The study of radiological parameters after surgery proves that the decrease in a small circle of self-improvement hypervolemia and cardiometric parameters occur mainly from 1 month to 6 years [1,9,11,13]. Some authors have proved that a decrease in the size of the PA occurs in 72% of cases 1-3 years after surgery. Complete normalization of the size and shape of the heart according to M.M.Ruzmetov [8], Anchabadze, G. O. et al. [1] occur rarely. These authors note in their research that these changes occur earlier and are more pronounced in children. Normalization of intracardiac hemodynamics leads to the elimination of blood discharge from left to right. In this regard, some patients have X-ray signs of LV enlargement in the long term after surgery [1,9,11,13]. Recently, to assess the dynamics of changes in the size of the heart after surgery, great importance has been attached to determining the volume of the heart.

The data of postoperative echocardiography prove that, compared with preoperative criteria in the immediate postoperative period, there is a decrease in the linear size of the right heart, the disappearance of volume overload; there were signs of an increase in the left heart; and in patients with TAPVD a small circle of self-improvement there are signs of left atrium overload. Most patients have an increase in ejection fraction, stroke volume, and, accordingly, cardiac index. The contractility of the myocardium in patients is within the normal range. During Doppler echocardiography after surgery, no pathological flows are detected and the complete integrity of the atrial septum is visualized in all patients, as noted by other authors [3,7,12,]. It should be emphasized that good and satisfactory results were obtained in those patients who had grade I and II pulmonary hypertension before surgery and, importantly, those who underwent surgery were under the age of 18.

#### Conclusions:

1. The study of the results of surgical treatment of APVD showed good and satisfactory results in 90.2% of cases. Despite the results obtained, we consider it advisable to correct this defect mainly in conditions of artificial blood circulation.
2. A large number of good results of surgical treatment of APVD were obtained in children under 5 years of age, which is confirmed by research data indicating normalization of indicators.
3. Radical correction of the defect performed in patients over the age of 18 leads to an improvement in their condition. However, the positive dynamics of pathological changes caused by malformations in them is less pronounced than those operated on in childhood.

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