



## **REGRESSION OF PULMONARY HYPERTENSION AFTER CORRECTION OF ABNORMAL PULMONARY VEIN DRAINAGE**

**Mamatov M.A.**  
**Abrolov H.K.**  
**Akbarkhonov B.A.**

State Institution "Republican Specialised Scientific and Practical Medical Centre of Surgery named after Academician V.Vakhidov".  
Tashkent. Uzbekistan

### **Article history:**

**Received:** January 3<sup>rd</sup> 2024  
**Accepted:** February 26<sup>th</sup> 2024

### **Abstract:**

The widespread prevalence of cardiovascular diseases accompanied by a rather high mortality rate predetermined the progress and modern trends in the development of cardiac surgery. In this aspect, over the last two decades, remarkable successes have been achieved in the diagnosis and surgical treatment of complex congenital heart defects, and anomalous pulmonary vein drainage can be included to them.

**Keywords:** pulmonary hypertension, correction of anomalous drainage, pulmonary veins

**INTRODUCTION.** Pulmonary hypertension is a severe pathology of the cardiovascular system, which has an extremely unfavourable prognosis if untreated [2,3,8,11]. Echocardiography (ECHO) as a simple noninvasive method of investigation provides objective information about the state of intracardiac and central haemodynamics in patients with anomalous pulmonary vein drainage before and after surgical correction of the malformation [4,9,15]. Inclusion of echocardiography in the programme of examination of operated patients helps to determine an individual system of rehabilitation measures. The use of methods of mathematical processing and analysis of echocardiograms allows to correct functional indices of the left and right heart sections in dynamics before and after surgery [5,14]. Simplicity and safety, absence of contraindications allow to recommend echocardiogram as one of the main methods of investigation in patients with anomalous pulmonary vein drainage. The study of the results of surgery in the nearest future is one of the reliable indicators of the expediency of this or that method of surgical treatment, which allows to evaluate the quality and effectiveness of correction [6,13]. Studies on the results of surgical treatment with anomalous pulmonary vein drainage in the literature are covered in single scientific papers and more often in a small number of observations. In most cases they are investigated together with other research methods. [5,10,12].

**PURPOSE OF THE STUDY:** To investigate the regression of pulmonary hypertension after surgical treatment of anomalous pulmonary vein possession using echocardiography.

**MATERIAL AND METHOD OF STUDY:** The clinical material consisted of 221 operated patients in RSNPMCH named after academician V.Vakhidov with anomalous pulmonary vein drainage. The age of operated patients ranged from 1 month to 45 years (average  $13.3 \pm 0.26$  years). All patients underwent EchoCG before and after the operation of the malformation. Based on the data of clinical and instrumental examination, total with abnormal pulmonary vein drainage was detected in 72 (32.5%) patients and partial with abnormal pulmonary vein drainage in 149 (67.5%) patients. Echocardiographic study was performed on ultrasound Doppler-echocardiograph "Toshiba" (Japan) and Logiq-P6 "General Electric Healthcare" (USA) and included one- and two-dimensional scanning of heart structures.

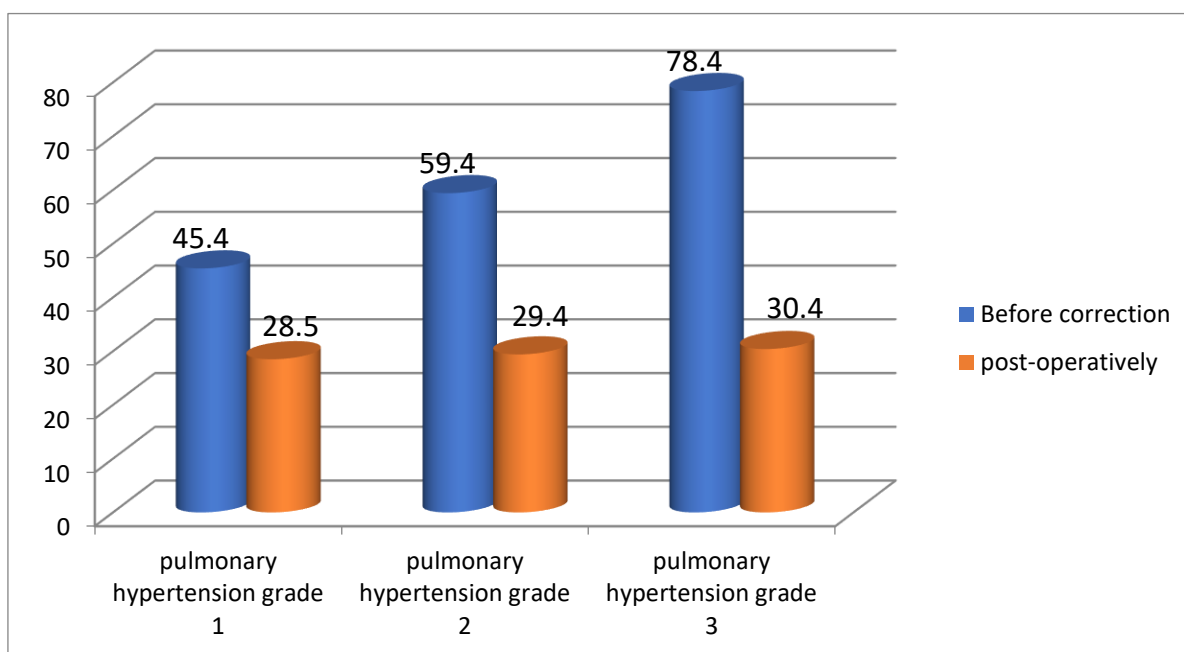
**RESULTS AND DISCUSSION.** Out of 221 operated patients with different variants of anomalous pulmonary vein drainage, pulmonary hypertension was detected in 96,8% (214) patients (Table 1). Thus, I degree of pulmonary hypertension was established in 51,1% (113) patients; II degree - in 34,8% (77) patients and III degree - in 10,8% (24) patients, only 7 (3,2%) patients with partial anomalous pulmonary vein drainage had no pulmonary hypertension (Table 1). The mean right ventricular (RV)/left ventricular (LV) systolic pressure ratio was  $42.6 \pm 7.4\%$ ;  $57.5 \pm 8.3\%$  and  $80.6 \pm 6.5\%$ , respectively. All tensiometric parameters obtained by echocardiography were compared with intraoperative data.

**Table 1.**  
**Distribution of patients by degree of pulmonary hypertension**

Degree pulmonary hypertension	Partial with abnormal pulmonary vein drainage		Total abnormal pulmonary vein drainage.		Ratio of right ventricle to left ventricle in % P<0,01
	n	%	n	%	
I degree	112	50,6	1	0,45	42,6 ± 7,4
II degree	26	11,7	51	23,07	57,5 ± 8,3
III degree	4	1,8	20	9,04	80,6 ± 6,5
Total	142	64,1	72	32,45	58,5 ± 4,3 (в среднем)

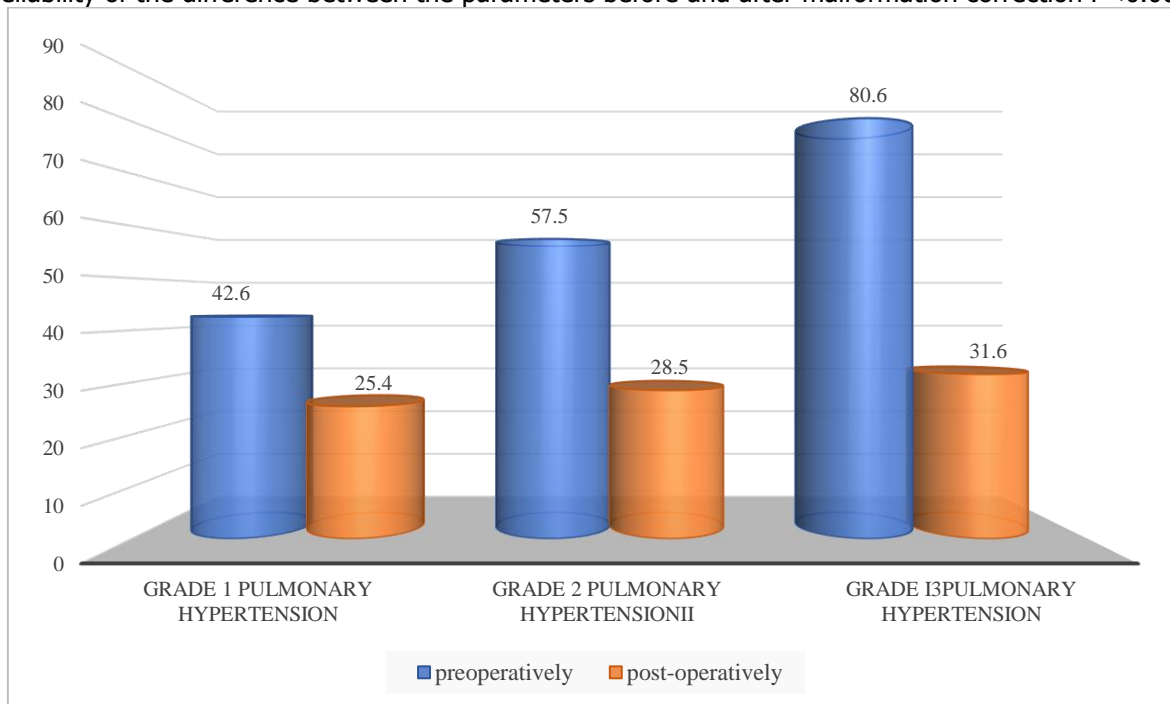
Thus, the majority of patients had pulmonary hypertension (85.9%) with the ratio of LV/LV systolic pressure between 40% and 70%. In 24 patients with anomalous pulmonary vein drainage with pronounced pulmonary hypertension 20 (83,3%) - were with total anomalous pulmonary vein drainage and 4 (16,7%) - were with partial anomalous pulmonary vein drainage. The data of intraoperative tensiometry in patients with anomalous pulmonary vein drainage showed that pulmonary hypertension in all cases had hypervolemic character, significantly depended on the number of anomalously draining pulmonary veins, on the age of patients and duration of the malformation. In the group of patients with pulmonary hypertension of the i-th degree the pressure in la averaged 45.3±6.4 mmHg; and in pulmonary hypertension of the ii - ii-th degree 59.4 ± 7.3 mmHg and 78.4 ± 5.3 mmHg, respectively (Figure 1). Thus, patients with pulmonary hypertension of II - III degree, as a rule, had anomalous drainage of at least two pulmonary veins (PV), and the age of

patients was, on average, 15 ± 0.59 years, i.e., the existence of the malformation was long and, therefore, the reasons for the development of pulmonary hypertension of time were plenty. In all patients with anomalous pulmonary vein drainage with pulmonary hypertension after the correction of the malformation, the pressure in the lungs significantly decreased and averaged 27.5 ± 1.8 mmHg, in patients with I-degree pulmonary hypertension after surgery the average was - 28,5 ± 2,1; in patients with i-degree pulmonary hypertension - 29,4 ± 1,8 and in patients with ii-degree pulmonary hypertension - 30,4 ± 0,72 mm.Hg. After correction with abnormal pulmonary vein drainage in the immediate postoperative period, the percentages of PF/LV pressure ratio by group were 25.4 ± 3.2%; 28.5 ± 4.5%; 31.6 ± 2.7%, respectively. The obtained data once again testify that in patients with anomalous pulmonary vein drainage pulmonary hypertension has hypervolemic character..



**A. Systolic pressure in the LV in mm.Hg.**

(Note: reliability of the difference between the parameters before and after malformation correction  $P < 0.001$ ).



**B. Ratio of systolic pressure in LV/LV (%)**

(Note: reliability of the difference between the indices before and after malformation correction  $P < 0.001$ )

In patients with high pulmonary hypertension in the immediate postoperative period, decompensation of heart failure often developed despite adequate correction of the malformation.

In comparison with preoperative echocardiographic criteria in the immediate postoperative period, there was a decrease in linear dimensions of the right heart sections, disappearance of volume overload; there were signs of enlargement of the left heart sections; and in patients with total anomalous pulmonary vein drainage there were signs of left atrial overload. The majority of patients have increased ejection fraction, stroke volume and cardiac index accordingly. Myocardial contractility in patients is within normal limits. In postoperative Doppler echocardiographic study, no pathological flows are detected and complete integrity of the atrial septum is visualised in all patients [5,7,10,12,13].

According to the literature [1,5,7,10], a sufficient number of operated patients with anomalous pulmonary vein drainage may still have signs of venous stasis in the small circulation circle after surgery due to inadequate size of the anastomosis, presence of pulmonary vein stenoses and creation of a relatively

narrow channel carrying out blood outflow from the LV to the left atrium.

Out of 221 operated patients with anomalous pulmonary vein drainage in the nearest postoperative period 198 (89,5%) had good results. Intraoperative tensiometry proved that the pressure of the heart cavities indicated that immediately after the operation the pressure in the right heart compartments decreases to normal values; this proves that pulmonary hypertension in patients with anomalous pulmonary vein drainage is often of hypervolemic nature.

**CONCLUSIONS:** Thus, EchoCG is an integral part of the ale pulmonary hypertension or rhythm of investigation of patients with suspected pulmonary hypertension. Since the important advantages of the latter are non-invasiveness and informativeness, it should be noted that all data obtained by EchoCG should be evaluated in conjunction with the clinical picture. All information obtained is extremely important and necessary to evaluate the effectiveness of correction with abnormal pulmonary vein drainage. Only such an approach can allow to obtain the optimal effect of therapeutic and diagnostic measures.



## LITERATURE

1. Бокерия Л.А, А.И.Ким, Д.О.Беришвили с соавт., «Промежуточные и отдаленные результаты радикальной коррекции супракардиальной формы тотального аномального дренажа легочных вен по методу Tucker и соавторов у новорожденных и детей первого года жизни» // Грудная и сердечно-сосудистая хирургия. - 2010. - №3 - с.30-35.
2. Бураковский В.И., Бокерия Л.А. Сердечно-сосудистая хирургия. М.: «Медицина». 2004.
3. Клименко А. А., Шостак Н. А.// Лечение легочной артериальной гипертензии: актуальные вопросы / Андрияшкина и др. // Кардиология: новости, мнения, обучение. – 2019. – № 7 (3). – С. 46–55.
4. Лукашкина Е.Ф. Эхокардиометрия в диагностике и диспансерном наблюдении детей с врожденными пороками сердца. Вопросы охраны материнства и детства.- 1986.-Т. 31.-N.12.-С. 22-24.
5. Обухов И.В. Результаты хирургического лечения аномального впадения правых легочных вен в верхнюю полую вену. Автореферат канд. дисс. Новосибирск. - 1984. - С. 115.
6. Подзолков В.П., Кассирский Г.И. (ред.). Реабилитация больных после хирургического лечения врожденных пороков сердца. М.: НЦССХ им. А.Н. Бакулева; 2015.
7. Связов Е.А. Сравнительный анализ отдаленных результатов коррекции частичного аномального дренажа легочных вен в верхнюю полую вену. //Сибирский 462 «ISSN 2181-712X. EISSN 2181-2187 2 (34) 2021 медицинский журнал (Томск). – 2017.- Т.32. -№1.
8. Хопер М.М., Крамер Т., Пан З. и др. Смертность при легочной артериальной гипертензии: прогнозирование с помощью модели стратификации риска Европейских рекомендаций по легочной гипертензии 2015 года. Европейский респираторный журнал 2017. **50** 1700740. (<https://doi.org/10.1183/13993003.00740-2017>)
9. Aduen J. F., R. Castello, M. M. Lozano et al. An alternative echocardiographic method to estimate mean pulmonary artery pressure: diagnostic and clinical implications / // J. of The Amer. Society Echocardiography. – 2009. – № 22. – P. 814–889.
10. Chandra D., Gupta A., Nath R.K., et al. Surgical management of anomalous pulmonary venous connection to the superior vena cava-early results. Indian Heart J. 2013 Sep-Oct;65(5):561-5. doi: 10.1016/j.ihj.2013.08.013. Epub 2013 Sep 8. PMID: 24206880; PMCID: PMC3860787. (65).
11. Galie N., M. Humbert, J. L. Vachiery et al. Guidelines for the diagnosis and treatment of pulmonary hypertension. The Joint Task Force for the Diagnosis and Treatment of Pulmonary Hypertension of the European Society of Cardiology (ESC) and the European Respiratory Society (ERS) / // European. Respiratory J. – 2015. – № 46 (4). – P. 903–975.
12. Jie Hu, Renjie Hu, Haibo Zhang et al. Outcomes of Surgical Repair of Partial Anomalous Pulmonary Venous Connection to SVC // Thorac. Cardiovasc. Surg. 2020. Vol. 68, N 1. P. 24-29.
13. Kelle, A. M., C. L. Backer, J. G. Gossett [et al.] Total anomalous pulmonary venous connection: results of surgical repair of 100 patients at a single institution // J. Thorac. Cardiovasc. Surg. - 2010. - V. 139. - P. 1387-1394 e3.
14. Lang R. M., L. P. Badano, V. Mor-Avi et al. Recommendations for cardiac chamber quantification by echocardiography in adults: an update from the American Society of Echocardiography and the European Association of Cardiovascular Imaging / // Europ. Heart J. – Cardiovascular Imaging. – 2015. – № 16. – P. 233–271.
15. Naing P., H. Kuppusamy, G. Scalia et al. Non-Invasive assessment of pulmonary vascular resistance in pulmonary hypertension: current knowledge and future direction / // Heart Lung and Circulation. – 2017. – № 26 (4). – P. 323–330.