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Surgical Correction of Incomplete Anomalous Pulmonary Venous Drainage

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ABSTRACT

For the period from 2001-2021. 149 patients aged 1.4 - 45 years with various anatomical variants of IAPVD were operated on in the Department of CHD Surgery of the RSSPSC named after academician V. Vakhidov and the clinic of the ASMI. The diagnosis of the defect was based on the analysis of a combination of data from clinical and special research methods, including echocardiography, multispiral computed tomography with contrast, and catheterization of the heart cavities with angiocardiography. Operations were performed from the median sternotomy and thoracotomy with the right lateral access, under cardiopulmonary bypass with pharmaco-cold cardioplegia. The types of surgery for partial anomalous drainage of the pulmonary veins were analyzed. Depending on the level of entry of the pulmonary veins and the location of the ASD, patients were divided into 4 groups: supracardial, cardiac, infracardial and displaced. 7 operated patients had an additional left-sided SVC opening into the coronary sinus.

Relevance

Incomplete anomalous pulmonary venous drainage (IAPVD) is a congenital heart disease characterized by drainage of one or more, but not all, pulmonary veins into the right atrium [1.4.6.12]. In a number of cases, anomalous pulmonary veins drain into the superior vena cava (SVC) or cava-atrial junction in combination with a sinus-septum defect [3,6,11,12,19]. It is generally accepted that regardless of the number and level of pulmonary venous drainage, the presence or absence of interatrial communication, a patient with APVD should be subjected to surgical intervention. At the same time, almost all operated patients have good results, and almost no lethal cases are observed [6,8,11,21].

So far, according to the authors, the surgical correction of the defect has been largely resolved, but, despite such a unity of views on the indications for IAPVD correction, many private issues remain the subject of discussion. Basically, they relate to the methods of surgical correction themselves, operative access and conditions for providing the operation. These points, although not of fundamental importance, but one way or another affect the final result [12,14,20]. With this in mind, in this report we present our approach to the surgical treatment of patients with IAPVD.

Purpose of the study: Scientifically substantiated to analyze the adequacy of the radical method of intracardiac reconstruction of incomplete anomalous pulmonary venous drainage using autopericardium.

Material and methods

For the period from 2001-2021. in specialized cardiac surgery departments of the RSSPSC named after acad. V. Vakhidov and ASMI clinic operated on 149 patients aged 1.4 years. - 45 years, mean age was (13.9±0.13) years, with different anatomical variants of IAPVD. The diagnosis of the defect was based on the analysis of a combination of data from clinical and special research methods, including echocardiography, multispiral computed tomography with contrast, and catheterization of the heart cavities with angiocardiography. Operations were performed from median sternotomy and thoracotomy with the right lateral approach, with an "open" heart, normothermic (46.5±3.4 min.) was performed in 83 patients, and hypothermic (68.5±5.6 min.) artificial blood circulation with pharmaco-cold cardioplegia. Of the 149 patients, 142 IAPVD was combined with an atrial septal defect (ASD); 7 patients did not have an ASD and 17 had small defects, in all these patients the ASD was expanded to the required size so that the blood flowing from the pulmonary veins would not become obstructed. In 19 patients one pulmonary vein anomalously emptied, in 88 two and in 42 three. Depending on the level of entry of the pulmonary veins and the location of the ASD, the patients were divided into 4 groups: in patients of the first group (83 patients), abnormal pulmonary veins flowed into the SVC, in patients of the second group (58 patients), into the right atrium; in 1 patient of the third group, the abnormal pulmonary veins flowed into the IVC and in 7 patients the place of confluence was mixed. In 7 (4.6%) operated patients, there was an additional left-sided SVC opening into the coronary sinus.

Result and discussion

There were no lethal outcomes among the 149 operated patients; all of them were discharged from the clinic without signs of heart failure and practically without complaints, in a satisfactory condition. At the same time, our experience and analysis of the literature show that the variety of surgical methods of treatment and conditions for their provision, used in the correction of the venous sinus defect and IAPVD, is explained by the relative "simplicity" of the anatomical components of the defect. So, in the cardiac type, the orifices of abnormally draining pulmonary veins and the plane of secondary ASD are located at the same level and close to each other. In patients with such defects, it is sufficient to suture the anteromedial mobile edge of the defect over the orifices of the pulmonary veins, thus relocating them through the defect to the left atrium [2,8,10]. We encountered a similar variant of the defect in 4 cases and did not experience technical difficulties in correcting it, but it should be taken into account that the sutured edge of the defect should be able to freely approach the PP wall. In cardiac surgery practice, this method of correction using the free edge of an ASD is the most popular, and when suturing the edge of the defect, a mattress suture can be used with the threads pricked out of the wall of the right atrium.

To date, the elimination of all four forms of APVD does not present any special technical problems and is usually performed with a longitudinal median sternotomy. However, median sternotomy as a surgical approach is characterized by high trauma and a high risk of developing mediastinitis [1,7,9,10], after which mortality can reach up to 71% [3, 4, 5, 11].

Considering all this, out of 149 operations with IAPVD, in 20 cases, the dislocation of abnormal PV in the LA was performed from a right-sided anterolateral thoracotomy along the fourth intercostal space. In the analyzed cases of the supracardial form of the confluence of the PV into the SVC, the cannulation of the latter was carried out using Pacifico cannulas. Correction of this form of anomalous drainage was necessarily supplemented by plastic expansion of the SVC according to J. Kirklin and according to our method (expansion from the lateral side of the SVC). In cardiac forms of IAPVD, an autopericardial patch was sutured in such a way that the orifices of the abnormal veins began to drain into the LA cavity.

All operations performed from right-sided anterolateral thoracotomy were performed without technical difficulties. The duration of EC and cardioplegia were comparable to those when using the standard technique. There was no need for conversion in any case, although there are reports in the literature where a standard median sternotomy had to be resorted to. The use of lateral right-sided thoracotomy led to a significant reduction in the total duration of the operation, shortening the time of mechanical ventilation and the length of the patient's stay in the intensive care unit, as well as a decrease in the postoperative stay of the patient in bed by 6.1±0.7 days. Patients noted particular satisfaction in connection with the achieved cosmetic effect. There were no lethal outcomes.

With such anatomy as a discrepancy between the levels of localization of the orifices of the pulmonary veins and the plane of the ASD, then in the presence of an open oval window or a small defect, it becomes necessary to increase the interatrial communication by dissecting the septum [13]. In this case, it is necessary to take into account the area of the draining pulmonary veins and the plane of the ASD, so that after the operation there is no stagnation in the pulmonary circulation (PC) [6,15,16,22]. However, dissection of the interatrial septum increases the risk of arrhythmias, up to the development of a complete transverse blockade, due to the dangerous proximity of the pathways or blood vessels supplying them [10,14,17,20]. So, in 58 of our clinical observations (7 of them had no defect, and 10 of them were small), we forcedly dissected the interatrial septum down and up with further plastic displacement of the anomalous pulmonary veins using an isolated autopericardium. Fortunately, in all these cases, we did not observe grossly disturbed rhythm in the postoperative period.

With regard to the correction of the sinus venosus defect with IAPVD, we performed the dislocation of abnormally flowing pulmonary veins using a patch from the autopericardium (in 14 patients). In the literature, for the correction of defects in the venous sinus, the division of the SVC lumen into two channels is widely promoted [7,18]. We treat this method with caution, because obstruction of the SVC often develops in the long term, the recommended expansion of the vein with a patch [16,17,19], according to N.M. Amosov et al. M.M. Ruzmetova does not save from unwanted complications.

Some technical difficulties arise in situations where the pulmonary veins flow high into the trunk of the SVC: the orifices of the veins and the plane of the ASD are far apart. To correct an anomaly of this shape, the method used by J.I. Ehrenhaft et al., [24] can be used. The SVC is cut off above the mouth or mouths of the abnormal pulmonary veins, the cranial end of the cut SVC is anastomosed with the right atrial appendage after amputation of its apex, and the caudal end is tightly sutured. A patch inside the right atrium directs inflow from the orifice of the SVC through the ASD to the left atrium. This method, as emphasized by A.S. Ovakinyan et al. [9] and Svyazov E.A. [14] is the most acceptable and adequate method that we used in two observations. Some authors use the Warden method with a modification that preserves the function of the sinus node, and also provides non-restrictive blood flow in the pulmonary veins. M.Puig-Massana et al. [26] proposed an original method for mixed variants of IAPVD. In order to form a tunnel for diverting the pulmonary veins in the ASD, the very wall of the right atrium was used, which was dissected around the pulmonary vein ostia and sutured to the edges of the ASD: the anterior wall of the atrium was restored with a patch from the pericardium or, as recommended by A.N. Lewin et al., [25] with the auricle of the right atrium. This technique with new modifications is still used [7]. The idea of "autoatrioplastic" reconstruction is convenient, since the blood supply of the "patches" is not disturbed. However, in our opinion, this intervention prolongs the time of vena cava occlusion, although this operation is performed under IR or general hyperthermia.

Thus, in order to restore adequate drainage of the pulmonary veins out of 149 operations, we used the technique of J.I. Ehrenhaft et al. [24], in 4 cases, the ASD edge itself and in 144 cases,

plasty was performed using a patch from an auto- or xenopericardium.

In our opinion, the currently used methods for providing a “dry” surgical field during the correction of IAPVD require a separate analysis. So, E.E.Litasova et al. [7], S.D. Dzhoshibaev et al. [5], V.T. Selivanenko et al. [11], only general or craniocerebral hypothermia is used for this purpose. There are reports [6] when the operation is performed on a “closed”, beating heart without hypothermia. Although the proponents of these methods note the well-known positive aspects of hypothermia, they still stated recanalization of the defect in 8% of cases.

Many groups of authors [9,10,22,23] perform IAPVD correction of any form only under conditions of extracorporeal circulation. As emphasized above, in all observations we used cardiopulmonary bypass with or without cardioplegia. In our opinion, it is EC that makes it possible to adequately and reliably perform complex reconstructive and restorative interventions, the need for which often arises in case of abnormal drainage of the pulmonary veins.

Conclusions

1. For the most complete assessment of the results of correction of abnormal pulmonary drainage, a full examination of patients in the late postoperative period is necessary.
2. The volume and method of elimination of PALV should be chosen depending on the level of entry of the pulmonary veins, their relationship with the ASD plane. The most adequate and radical method is intracardiac reconstruction using autopericardium.
3. Midaxillary right lateral thoracotomy can be considered as a convenient access to perform the operation, which is relatively cosmetic especially for females.
4. General hypothermia can be successfully used to provide a “dry” surgical field for correction of IAPVD, however, cardiopulmonary bypass remains the method of choice.

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