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**БИОЛОГИЯ ЖӘНЕ МЕДИЦИНА
СЕРИЯСЫ**



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БИОЛОГИЧЕСКАЯ И МЕДИЦИНСКАЯ



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**THE DIRECT RESULTS OF THE RADICAL CORRECTION
OF VARIOUS FORMS
OF THE ATRIOVENTRICULAR SEPTAL DEFECT**

Abstract. The analysis of direct results of the surgical treatment of 23 patients with different forms of atrioventricular septal defect (AVSD) were submitted: partial form (12 patients), intermediate (transitional) form (8 patients) and complete form (3 patients). All patients underwent the radical correction of the congenital heart malformation, including one-patched, two-patched and «australian» methods. Complications in the early postoperative period developed in 11 (47,8%) patients, lethality was 8,7%.

Keywords: atrioventricular septal defect, radical correction, AV-blockage, bleeding.

Introduction. Atrioventricular septal defect (AVSD) is a complex congenital heart defect, occurring with a frequency of 4-5% in the structure of all congenital heart defects, or neonates at 2-4 per 10 000 births [1, 2, 8, 9]. AVSD is characterized by disorders of the atrioventricular valves in the form of creating a common atrioventricular ring, separating the atria and ventricles, as well as abnormalities of the leaflets and chordal-papillary apparatus. It is generally accepted the division of AVSD 4 anatomical forms: a partial or partial, transitional, intermediate and complete. In turn, the full form of AVSD has balanced and unbalanced subtypes. In full form of AVSD there is no fibrous portion, which separates normal mitral and tricuspid annulus fibrosus, and atrioventricular septal defect. According to Rastelli [11], the atrioventricular apparatus at full form of AVSD is divided into three types: A, B and C. The diagnosis is set with the left ventriculography, which distorts the outflow of the left ventricle on the type "goose neck", mitral regurgitation and discharge of blood through the VSD with the complete form of AVSD [4, 5].

The purpose of the research is to examine the results of radical correction of various forms of atrioventricular septal defect.

Material and Methods

23 patients who were hospitalized in the Department of Cardiac Surgery at A. N. Syzganov NSSC (KazMUCE clinical base) in the period from 2011 to 2016 were subjected to a retrospective analysis. The average age of the patients was $21,7 \pm 15,3$, the youngest of which was 4 months old, the oldest – 51 years old. Females dominated (65.2%) among the patients. The patients were divided into three groups depending on the AVSD form: with partial form (12 patients), intermediate (transition) form (8 patients) and with a balanced complete form (3 patients). All patients underwent radical defect correction. General characteristics of the patients before the operation are shown in Table 1.

Processing of data, including statistics, was carried out with the help of software applications for Windows (Excel, Access), as well as Statistica 5,5. Mean values were presented with standard deviation ($M \pm m$). Differences between mean values were considered significant for values of $p < 0,05$. Stratification of the risks associated with surgery, was performed with the help of Aristotle basic complexity score (ABC score) and Risk adjustment for congenital heart surgery – 1 (RACHS-1).

Table 1 – General characteristics of the patients before the operation

Characteristics	AVSD, partial form	AVSD, intermediate (transition) form	AVSD, balanced complete form	p		
	1	2	3	1-2	2-3	1-3
Number (%)	12 (52,2)	8 (34,8)	3 (13,0)	–	–	–
Average age (years)	27,3±15,5	22,4±11,0	2,0±2,6	0,397	0,047	0,028
Females	7	6	2	–	–	–
Males	5	2	1	–	–	–
ABC score (category of complexity)	6,2±4,0 (II)			-	-	-
RACHS-1 (category of complexity)	II	II-III	III	–	–	–
IC time (min)	144,0±61,8	120,8±19,1	119,0±9,9	0,577	0,204	0,957
Aortic cross-clamping time (min)	111,8±54,0	92,8±22,7	89,5±5,0	0,633	0,824	0,805

Results of the research

In the early postoperative morbidity the complex course was observed in 11 (47.8%) patients, 2 patients (8.7%) died. The cause of two deaths after radical correction of the complete form of AVSD was intractable acute heart failure which required high doses of inotropes. In the other 3 cases we could handle the symptoms of acute heart failure; all patients with stable hemodynamics were transferred to the profile department and later were dismissed.

The structure of the non-lethal and lethal complications is shown in Table 2, according to it, the greatest number of complications was observed in patients with partial and complete AVSD forms. Whereas in patients with intermediate (transitional) form of AVSD early postoperative period in most cases proceeded smoothly: postoperative complications in the form of a complete transverse blockade were observed in only one patient (12.5%).

Two (8.7%) repeated sternotomy due to drainage bleeding were made in the early postoperative period there. The source of bleeding in one female patient with complete AVSD form was the right ventricular wall at the site of a bound temporary electrode, in another patient with a partial form of AVSD the definition of the hemorrhage source was not possible.

In the early postoperative period, conduction disorders in the form of AV block of 3 grade occurred in 4 patients, which accounted for 17.4% of the total number of patients: in 3 patients (13.1%) – after radical correction of AVSD partial form, in 1 (4, 3%) – after radical correction of an intermediate form of AVSD. Subsequently, all patients underwent implantation of a permanent pacemaker.

Table 2 – The structure of the non-lethal and lethal complications in early postoperative period

Non-lethal and lethal complications	AVC, partial form, n=12		AVC, intermediate (transition) form, n=8		AVC, complete form, n=3	
	abs.	%	abs.	%	abs.	%
Acute heart failure	3	25,0	–	–	2	66,7
Hemorrhage	1	8,3	–	–	1	33,3
AB-block of 3grade	3	25,0	1	12,5	–	–
Total	7	58,3	1	12,5	3	100,0

Hospital mortality in surgical treatment of AVSD was 8.7%. 2 children aged 4 and 6 months with complete balanced forms of AVSD died as a result of intractable acute heart failure, the first on the day of operation, and the second on the next day after surgery. Both patients underwent radical defect correction: one of them by one-flap method, the second by two-flap method. In addition to this, 4-month-old baby suffered from Down's syndrome, and at six-month girl's AVSD was combined with secondary pulmonary

high hypertension. Despite adequate surgical correction of the form of disease, it was not possible to provide in both cases a stable hemodynamic condition in the early postoperative period, which resulted in a fatal outcome.

Discussion. In our study, surgical correction of AVSD in most cases did not present any difficulties that might seriously impair the results of treatment. According to numerous studies, the majority of operated patients in the mid-term and long-term periods after radical correction of AVSD are at lower functional classes, in other words hardly have any significant problems with the physical and psychological health, which limit their activities of daily life [1, 2, 3, 8]. According Buratto E et al. (2016), 10-year survival after surgical correction of various forms of AVSD is 90%, 20-year survival rate is 83%, and freedom from reoperation at 10 and 20 years is about 66% [8].

However, according to some authors, the early and late possible complications after surgical correction of AVSD can be [1, 6, 7, 8, 9, 10, 12]:

- damage of the pathways with the occurrence of cardiac arrhythmias and conduction in the form of incomplete and full cross-section of the block;
- damage to the circumflex branch of the left coronary artery with the annuloplasty anterior-lateral commissure of the mitral valve;
- residual regurgitation in the atrioventricular valves;
- stenosis of the atrioventricular orifices;
- stenosis of the outflow of the left ventricle.

With explicit deficit of tissue flaps, prosthesis of valve should be preferable. In marked domination of one of the ventricles, two ventricles correction should be abandoned in favor of one ventricles Fontan correction [2, 3, 7].

The need for reoperation on the mitral valve after radical correction of the complete form of AVSD may be caused, firstly, by unreasonable extensive use of plastic reconstruction methods in severe initial pathology of the mitral valve component, and, secondly, by surgical errors in a poorly executed reconstruction of the mitral valve component [7].

The deficit of valvular tissue, relative hypoplasia of the right or left ventricular, abnormalities of fastening flaps, chords and papillary muscles, double-orifice mitral valve, one group of left ventricular papillary muscles are the independent risk factors for reconstructive correction of complete form of AVSD. A number of surgeons consider the reconstruction of affected valves as operation choice, others at total failure in common atrioventricular valve with additional anomalies, perform initial prosthesis [7].

Conclusion. Thus, AVSD is a congenital heart defect, which has different forms, which are connected with a process involving the atrial and ventricular septal and anatomical changes in the atrioventricular flap and subvalvular structures. In our study, the highest percentage of cases consisted of patients with partial and intermediate forms of AVSD (86.9%), which surgical correction in most cases did not present any problems. On the other hand, 2 (8.7%) deaths occurred in the immediate postoperative period in young patients with complete AVSD form. The cause of hospital death in both cases was intractable acute heart failure.

REFERENCES

- [1] Bokerija L.A., Gorbachevskij S.V. Atrioventrikuljarnyj kanal. Anatomija i osobennosti hirurgicheskoj korrekcii. M.: Izd-vo NCSSH im. A. N. Bakuleva RAMN, 2005.
- [2] Gorbatyh Ju.N. i soavt. Radikal'naja korrekcija otkrytogo atrioventrikuljarnogo kanala. Medicinskaja tehnologija. Novosibirsk, 2008. 33 p.
- [3] Sagatov I.E. Sravnitel'naja ocenka rezul'tatov razlichnyh metodov operacii Fontena v hirurgicheskom lechenii vrozhdennyh porokov serdca: Dis. d.m.n. Moskva, 2008. 250 p.
- [4] Sagatov I.E. Metody hirurgicheskogo lechenija slozhnyh vrozhdennyh porokov serdca. Almaty, 2014. 34 p.
- [5] Sagatov I.E. Operacionnyj risk i kachestvo zhizni u pacientov kardiohirurgicheskogo profilja. Almaty, 2015. 142 p.
- [6] Abarbanell G.L., Morrow G., Kelleman M.S., Kanter K.R., Border W.L., Sachdeva R. Echocardiographic Predictors of Left Ventricular Outflow Tract Obstruction following Repair of Atrioventricular Septal Defect: Congenit Heart Dis. 2016 May 12. doi: 10.1111/chd.12370.
- [7] Bokeria L.A., Gorbachevsky S.V., Makhachev O.A., Kim A.I., Rahmonov K.H., Fillipkina T.Y. Mitral valve replacement in complete atrioventricular septal defect: choice of the prosthesis and risk factors // 60-th ESCVS International congress. M.: 20-22 May, 2011. P. 80.

- [8] Buratto E., Ye X.T., Bullock A., Kelly A., d'Udekem Y., Brizard C.P., Konstantinov I.E. Long-term outcomes of reoperations following repair of partial atrioventricular septal defect // Eur J Cardiothorac Surg. 2016 Aug; 50(2): 293-297.
- [9] Devlin P.J., Backer C.L., Eltayeb O., Mongé M.C., Hauck A.L., Costello J.M. Repair of Partial Atrioventricular Septal Defect: Age and Outcomes // Ann Thorac Surg. 2016 Jul; 102(1): 170-177.
- [10] Moreno N., Almeida J., Amorim M.J. Atrioventricular septal defect in an adult patient // Rev Port Cardiol. 2016 Mar; 35(3): 181.
- [11] Rastelli G.C., Ongley P.A., Kirklin J.W. Surgical repair of the complete form persistent common atrioventricular canal // J Thorac Surg. 1968; 55(3): 299-307.
- [12] Sagatov I.Ye. Modeling of the operational risk in patients with congenital heart diseases // Cardiology. 2015; 131(Suppl 1): 29-30.

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ӘРТҮРЛІ АТРИОВЕНТРИКУЛЯРЛЫҚ ПЕРДЕ АҚАУЫНЫҢ РАДИКАЛДЫҚ ТҮЗЕТУДІҢ ЕРТЕ НӘТИЖЕЛЕРІ

Аннотация. Атриовентрикулярлық перде ақауының әртүрлі формасына шалдыққан 23 науқасты хирургиялық емдеудің ерте нәтижелерін талдау ұсынылған: оның ішінде 12 науқаста толық емес формасы, 8 науқаста аралық (өтпелі) формасы және 3 науқаста толық формасы болды. Барлық науқастарға бір төсемелі, екі төсемелі және «австралиялық» әдістерін қамтыған туа біткен ақауды радикалды түзету жүргізілді. 11 науқаста (47,8%) ерте ота кезіндегі асқынулар орын алды, өлім көрсеткіші 8,7 % құрады.

Түйін сөздер: атриовентрикулярлық перде ақауы, радикалды түзету, АВ-блокада, қан кету.

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РАННИЕ РЕЗУЛЬТАТЫ РАДИКАЛЬНОЙ КОРРЕКЦИИ РАЗЛИЧНЫХ ФОРМ АТРИОВЕНТРИКУЛЯРНОГО СЕПТАЛЬНОГО ДЕФЕКТА

Аннотация. Представлен анализ непосредственных результатов хирургического лечения 23 пациентов с различными формами атриовентрикулярного септального дефекта: неполной (12 пациентов), промежуточной (переходной) (8 пациентов) и полной формами (3 пациентов). Всем пациентам выполнена радикальная коррекция порока, в том числе однозаплатным, двухзаплатным и «австралийской» методикам. Осложнения в раннем послеоперационном периоде возникли у 11 (47,8%) пациентов, летальность составила 8,7%.

Ключевые слова: атриовентрикулярный септальный дефект, радикальная коррекция, АВ-блокада, кровотечение.

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