

COMPARATIVE EVALUATION OF IMMEDIATE RESULTS OF PLASTIC ATRIAL SEPTAL DEFECT IN ADULT PATIENTS, LIVING IN HIGH ALTITUDE CONDITIONS

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Conflict of interest

The authors declare that they have no
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Keywords

atrial septal defect,
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Abstract

The article gives a comparative assessment of the results of surgery for atrial septal defect (ASD) surgery in patients living in low and high altitude conditions, sizes of the right ventricle were practically equal, but at the same time higher than the normal.

Objective. To conduct a comparative analysis of the direct results of ASD plastic in patients living in low, medium and high mountains

Material and methods. The study material included 30 patients with ASD living in highlands; the control group consisted of 30 patients living in flat areas. Using clinical methods and instrumental studies, an analysis of operated patients, ASD plastic in adult patients with complicated pulmonary hypertension, heart failure, cardiac arrhythmias and functional tricuspid insufficiency was performed.

Results. The authors studied pulmonary arterial pressure (PAP) indices between the groups both in the preoperative and postoperative periods, the analysis showed significant differences. The parameters of the right ventricle (RV) in the preoperative period had significant differences, however, in the postoperative period, the sizes of the right ventricle were practically equal, but at the same time higher than the normal.

Conclusion. Our observation data show a significant decrease in PAP in patients living in high altitude conditions. However, the decrease in the PAP indicators remained slightly higher than the standard indicators.

**Биік тау жағдайында өмір сүретін ересек науқастардың жүрекшеаралық перде
ақауының пластикасының ерте нәтижелерін салыстырмалы бағалау**

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Аңдатпа

Мақалада аласа және биік тауларда тұратын науқастарда жүрекшеаралық пердесінің ақауы (ЖПА) хирургиясының нәтижелерін салыстырмалы бағалау қарастырылған.

Материалдар және әдістер. Зерттеу материалына биік таулы жерлерде тұратын 30 науқас, бақылау тобына жазық жерлерде тұратын 30 пациент кірді. Клиникалық әдістерді және аспаптық зерттеулерді қолдана отырып, операция жасалған науқастарды талдау, асқынған өкпе гипертензиясы, жүрек жеткіліксіздігі, жүрек ырғағының бұзылуы және үшжармалық функционалдық жеткіліксіздігі бар ересек пациенттерде ЖПА пластикасы жасалды.

Нәтижелер. Авторлар операцияға дейінгі кезеңде де, операциядан кейінгі кезеңде де топтар арасындағы өкпе артериялық қысымының (ӨАҚ) көрсеткіштерін зерттеді, талдау айтарлықтай айырмашылықтарды көрсетті. Операция алдындағы кезеңде оң жақ қарыншаның (ОЖҚ) көрсеткіштері айтарлықтай айырмашылықтарға ие болды, алайда операциядан кейінгі кезеңде оң жақ қарыншаның өлшемдері іс жүзінде бірдей болды, бірақ сонымен қатар нормадан жоғары болды.

Қорытынды. Біздің бақылау деректеріміз биік тау жағдайында тұратын науқастарда өкпе артериясы қысымының (ӨАҚ) айтарлықтай төмендеуін көрсетеді. Дегенмен, ӨАҚ көрсеткіштерінің төмендеуі стандартты көрсеткіштерден сәл жоғары болып қалды.

Түйін сөздер

жүрекшеаралық пердесінің
ақауы, биік таулар, ересектер

Сравнительная оценка непосредственных результатов пластики дефекта межпредсердной перегородки у взрослых пациентов, проживающих в условиях высокогорья

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Аннотация

В статье рассматривается сравнительная оценка результатов операции пластики дефекта межпредсердной перегородки (ДМПП) у больных, проживающих в условиях низкогорья и высокогорья.

Материалы и методы. В материал исследования входили 30 больных с ДМПП, проживающих в условиях высокогорья в контрольную группу, входили 30 больных проживающих в равнинной местности. С использованием клинических методов и инструментальных исследований выполнен анализ оперированных пациентов, пластики ДМПП у взрослых пациентов осложненной легочной гипертензией, сердечной недостаточностью, нарушением ритма сердца и функциональной трикуспидальной недостаточностью.

Результаты. Авторами были изучены показатели легочно-артериальное давления (ЛАД) между группами как в дооперационном, так и послеоперационном периоде, проведенный анализ показал достоверные различия. Показатели же правого желудочка (ПЖ) в дооперационном периоде имели достоверные различия, однако в послеоперационном периоде размеры правого желудочка практически стали равными, но при этом выше нормы.

Заключение. Данные наших наблюдений показывают достоверное снижение легочно-артериального (ЛАД) давления у пациентов, проживающих в условиях высокогорья. Однако снижение показателей ЛАД осталось немного выше нормативных показателей.

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Конфликт интересов

Авторы заявляют об отсутствии конфликта интересов

Ключевые слова

дефект межпредсердной перегородки, высокогорье, взрослые

Relevance

In most cases, the clinical course of ASD is asymptomatic. Over time, most adult patients develop heart failure, which is directly related to an increase in left ventricular stiffness and a decrease in diastolic filling [1,2], which in turn lead to an increase in left-right shunt through ASD and volume overload of the right ventricle (RV). The main symptoms of the disease are shortness of breath, decreased exercise tolerance, fatigue and palpitations [3]. Long-term cardiac overloads gradually lead to various complications in the form of supraventricular and ventricular cardiac arrhythmias, thromboembolism and pulmonary hypertension [4,5,6].

Approaches to indications for surgical correction of congenital heart defects (CHD) have undergone significant changes over time. In 2008, it was proposed to operate on almost all defects with a left-to-right discharge of blood. In 2010, the indication for ASD correction was the ratio $Q_p/Q_s > 1.5$, PVS 1.5 (II a C). At the present time, approaches to operability have become more tougher, which are based on the assessment of PVS (PVS < 2.3 Wood units) (II a C) [7].

According to the international consensus adopted in 2005, high-altitude pulmonary hypertension (PH) is a syndrome that affects children and adults who live for a long time at altitudes above 2500 meters and is characterized by an average pulmonary artery pressure of 30 mm Hg and above or systolic pulmonary arterial pressure (PAP) 50 mm Hg and higher, measured at high altitude, right ventricular hypertrophy, heart failure, moderate hy-

poxemia, absence of excessive erythrocytosis (hemoglobin concentration < 19 g/l in women and < 21 g/l in men) [8].

Multicenter studies carried out in high altitude conditions confirm the role of hypoxia in the genesis of a number of congenital heart anomalies. It has been proven that the higher the altitude of the area of residence above sea level, the more frequent the occurrence of such defects as patent ductus arteriosus (PDA) [9], ASD, ventricular septal defect (VSD) [10].

There are numerous studies on prevalence of ASD and hemodynamic parameters in patients living in high mountainous areas, but there are no studies evaluating the results of operations performed in patients living in midland and high altitude conditions. In this connection, we studied the results of surgical treatment of ASD in patients living in the middle and high mountains.

Purpose of the study: to conduct a comparative analysis of the direct results of ASD plastic in patients living in low, medium and high mountains.

Material and methods

In this work, we analyzed 60 observations in patients over 30 years old who were operated at the Southern Regional Scientific Center for Cardiovascular Surgery of the Ministry of Health of the Kyrgyz Republic from 2010 to 2018. All patients underwent ASD plastic surgery under conditions of artificial circulation and blood cardioplegia. The study included a total of 60 patients.

Table 1.
Comorbidities in patients
with ASD

Comorbidities	1 group	2 group
Chronic obstructive bronchitis	12(40%)	18(60%)
Peptic ulcer and duodenal ulcer	2(6,6%)	5(16,6%)
Varicosity of lower limbs	4(13,3%)	2(6,6%)
Iron deficiency anemia	2(6,6%)	19(63,3%)

Table 2.
The distribution of
patients by functional
class in groups

Group #	FC I	FC II	FC III	FC IV
1 (n= 30)	-	28 (93,3%)	2 (6,6%)	-
2 (n= 30)	-	18 (60%)	10 (33,3%)	2 (6,6%)

To perform a comparative analysis, the patients were divided into 2 groups. The first group consisted of 30 patients, of which: 25 female and 5 males from 30 to 63 years old living in a flat area, the second group included 30 patients aged 30 to 66 years, of which 19 are female and 11 are males living in high altitude conditions.

The examined patients were diagnosed with the following concomitant diseases, which are presented in table 1.

According to our data, iron deficiency anemia in patients of group 2 was observed in 100% of cases, which is, respectively, associated with living in high mountains [11].

Preoperative diagnostics included general clinical research methods such as electrocardiography (ECG), echocardiography, and chest x-ray.

The data were analyzed using a statistical software package (Excel, Statistica 7). Values were statistically significant at $p < 0.05$.

The clinical condition of patients was assessed in accordance with the classification of the New York Heart Association (NYHA). The distribution of patients by functional class (FC) in groups is presented in Table 2.

It was revealed that 6.6% of patients in group 1 belonged to FC III. In group 2, the proportion of patients belonging to FC III increased to 33.3%. FC IV was observed in 2 patients, which amounted to 6.6%. It should be noted that patients with FC IV required long-term preoperative preparation with cardiotonic support with dopamine and diuretics.

When analyzing the ECG in some patients, the following cardiac arrhythmias were initially identified (Table 3).

Table 3.
Identified cardiac
arrhythmias in patients

Group #	Ventricular extrasystoles	Atrial fibrillation
1 (n= 30)	12(40%)	1(3,3%)
2 (n= 30)	16(53,3%)	2(6,6%)

Table 4.
Degree of ITV
in patients

Degree of ITV	Group # 1	Group # 2
I-II	11	7
II	18	16
III	1	5
IV		2

An echocardiographic study revealed that the majority of patients in the study groups showed enlargement of the right heart and functional insufficiency of the tricuspid valve (ITV) of varying degrees (Table 4).

Results

All patients underwent atrial septal defect plastic under extracorporeal circulation and blood cardioplegia. In the first group of patients in 19 cases and in the second group in 23 cases, the tricuspid valve plastic surgery was performed according to De Vega, and 1 patient underwent coronary artery bypass grafting. In the dynamics after the operation, there was a significant decrease in the RV and pulmonary blood pressure (PBP) indices in both groups. The data are presented in table 5.

Comparative analysis between the groups showed significant differences both in the preoperative and postoperative periods in terms of PBP. RV indices in the preoperative period had significant differences, however, in the postoperative period, the size of the right ventricle practically became equal, but at the same time higher than the norm (Fig. 1, 2).

When comparing the indicators of CTI and Ind. Moore, a significant decrease was noted according to the Moore index and an unreliable, insignificant decrease in the CTI (Fig. 3).

In the 1st and 2nd groups there was a significant ($p < 0.05$) decrease in the degree of PH in the early postoperative period.

In the preoperative period, cardiac arrhythmias were detected: in the 1st group of patients in the form of ventricular extrasystoles of 12 patients and

Group #1	Before surgery	After surgery	p
RV	3,9±0,5	2,7±0,3	p<0,05
PBP	58,9±9,08	30,3±4,9	p<0,05
Group #2	Before surgery	After surgery	p<0,05
RV	4,3±0,5	2,7±0,2	p<0,05
PBP	65,83±10,9	37,6±5,7	p<0,05

Table 5.
RV and PBP parameters
before and after surgery

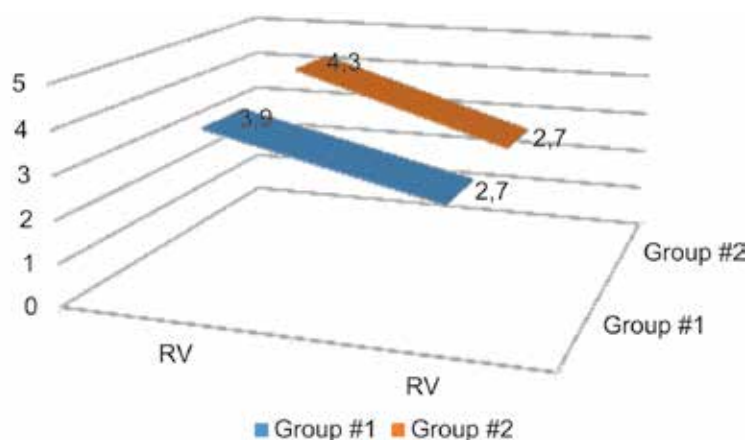


Figure 1.
PBP decrease.
Right ventricle before and
after surgery

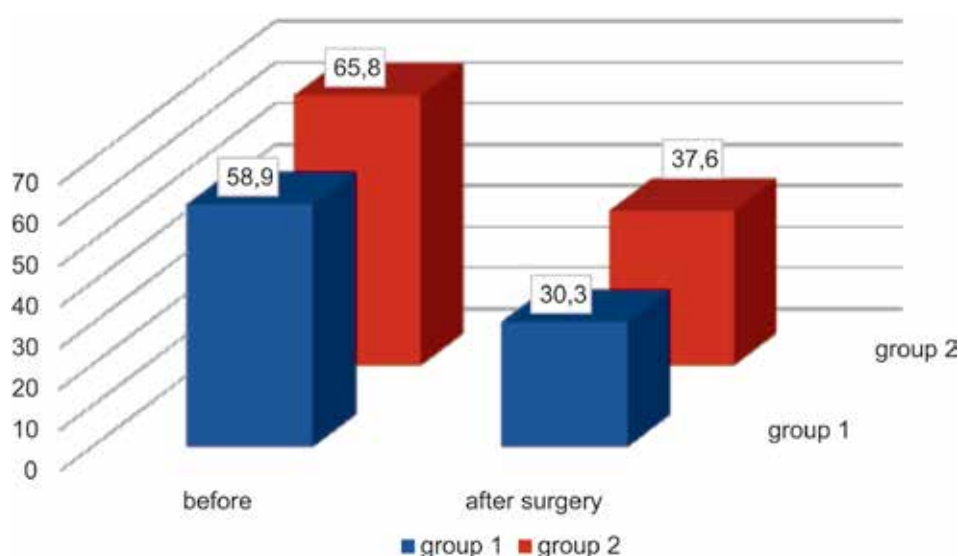


Figure 2.
PBP before and after
surgery

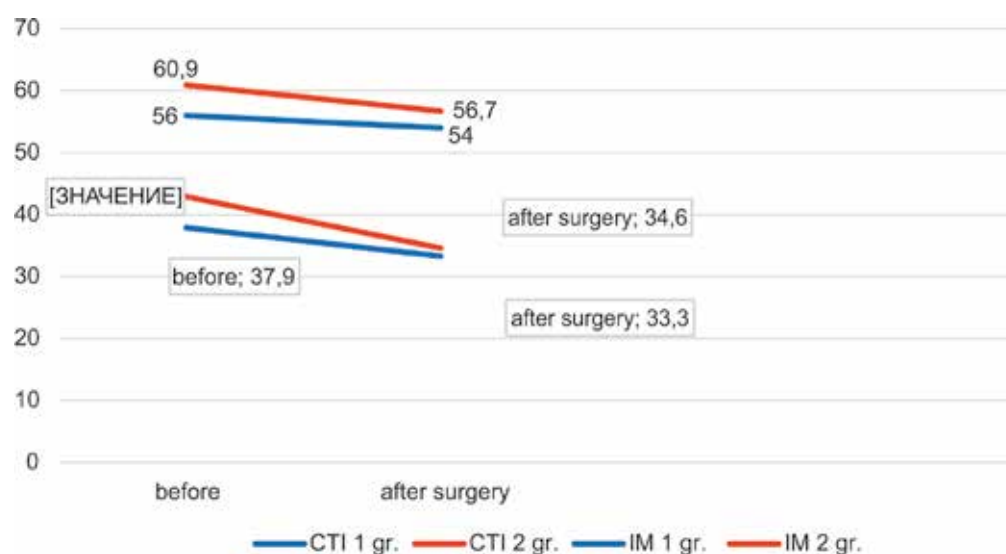


Figure 3.
CTI and Moore index
before and after surgery

atrial fibrillation in 1 patient. In the postoperative period, against the background of drug therapy, the sinus rhythm was restored. In group 2, atrial fibrillation was detected in 2 patients and ventricular extrasystoles in 16 patients. In 1 patient in the postoperative period, despite the ongoing therapy, atrial fibrillation was preserved.

Discussion

Functional failure of tricuspid valve (TV) with ASD from moderate to severe is a common problem in daily practice. Surgical treatment of ASD with TV plastic should be performed in a timely manner in accordance with the recommendations given in the current guidelines [12]. A variety of transcatheter devices are currently undergoing clinical trials to provide alternative treatment options for patients at high risk of surgical repair of TV. Despite promising early data on safety and efficiency, further research is needed for most devices aimed at restoring TV function [13]. Based on the above, surgical correction is still the main treatment for ASD.

Undoubtedly, in patients operated on at an older age, the risk of postoperative cardiovascular complications increases, especially in residents of the highlands, while children and young patients have an excellent result [14].

Despite numerous publications on remaining cardiac arrhythmias in the postoperative period [15,16,17], according to the results of our studies,

in most patients, despite arrhythmias of varying complexity and gradation in the preoperative period, which predominantly determine the severity of heart failure, by the time of discharge only atrial fibrillation persisted in one patient.

PH is the next major complication of ASD. Several researchers claim the presence of residual pulmonary hypertension in adult patients in the postoperative period [18]. Suzuki et al. note a decrease in PAP after ASD closure even in a patient carrying the BMPR2 mutation [19]. Our observation data show a significant decrease in PAP in patients living in high altitude conditions. However, the decrease in the PAP indicators remained slightly higher than the standard indicators.

Conclusions

1. Patients living in high altitude conditions generally had a higher NYHA class.
2. Indicators of pulmonary arterial pressure are significantly higher in the inhabitants of the highlands over the patients living in the low mountains.
3. In the early postoperative period, there is a significant decrease in pulmonary arterial pressure and indicators of the RV, CTI and Moore's index.
4. Despite the positive dynamics of a decrease in the size of the RV, there was no significant difference between the inhabitants of the low and high mountains.

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