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Comparative analysis of the success rate, complications and serum inflammatory factors in patients with congenital heart disease treated by interventional therapy and traditional surgical treatment.

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Abstract

Objective: To compare the success rate, complications and serum inflammatory factors in patients with congenital heart disease treated by interventional therapy and traditional surgical treatment.
Methods: A total of 80 patients with congenital heart disease from May 2016 to May 2017 in our hospital were divided by random number table into control group (traditional surgical treatment) and study group (interventional therapy) with 40 patients in each, with the approval of hospital ethics committee and informed consent of patients and their families. The success rate, incidence of complications and the changes of levels of serum inflammatory factors were observed and compared between the two groups.
Results: In the study group, the success rate was 100%, the incidence of complications was 7.5%, while in the control group 97.5% and 15% correspondingly, with no significant difference between the groups. The levels of serum inflammatory factors had no significant difference between the two groups before treatment, but the levels were significantly lower in the study group than in the control group after treatment.
Conclusion: Interventional therapy for congenital heart disease is superior to traditional surgery in terms of success rate, incidence of complication and serum inflammatory factor level, which should be used as the preferred treatment scheme.

Keywords: Interventional therapy, Traditional surgery, Congenital heart disease, Serum inflammatory factors.

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Introduction

Congenital heart disease is the most common birth defect in China, with the incidence rate as high as 0.8% and 300 thousand cases in China every year, which has become the first death cause for children under five years old in mainland [1]. In addition to the ischemia and hypoxia of the tissues and organs, the disease also leads to abnormal hemodynamics and cardiac structure, increases the cardiac burden, and increases the risk of heart failure, malignant arrhythmia and sudden death, and necessitates timely and effective treatment [2]. Surgery is the first choice for the treatment of congenital heart disease, especially with the development of interventional technology, and the curative effect has been effectively improved distinctly. Given this, the study was carried out on success rate, complications and serum inflammatory factors level changes in patients with congenital heart disease and treated by interventional therapy and traditional surgery separately, which was reported as follows.

Materials and Methods

Materials

A total of 80 patients with congenital heart disease from May 2016 to May 2017 in our hospital were divided by random number table into control group (traditional surgical treatment) and study group (interventional therapy) with 40 patients in each, under the approval of hospital ethics committee and informed consent of patients and their families. The control group consisted of 23 males and 17 females in gender, from eight months to 60 years old with average age of 30.25 ± 1.25 years in age, 17 cases of patent ductus arteriosus, 15 cases of atrial septal defect and eight cases of ventricular septal defect in disease type, 23 cases of level I and 17 cases of level II in American Society of Anesthesiologists classification (American Society of Anesthesiologists, ASA). The study group consisted of 25 males and 15 females in gender, from six months to 60 years old with average age of 30.30 ± 1.20 years in age, 16 cases of patent ductus arteriosus, 14 cases of atrial septal defect and ten cases of ventricular septal defect in

disease type, 25 cases of level I and 15 cases of level II in ASA classification. Inclusion criteria: patients diagnosed as congenital heart disease by symptoms, signs, ECG, X-ray and echocardiography; patients without blood system diseases or coagulation dysfunction; informed consent form signed by patients themselves and (or) their families. Exclusion criteria: patients of terminal malignant tumor or local/systemic severe infection; patients of level III or above in ASA classification; patients with contraindications for interventional therapy or surgical treatment. There was no significant difference between the two groups in general data, so it could be compared by random grouping.

Methods

The control group was given traditional surgical treatment carried out as follows: split the sternum in the middle after local or general anesthesia, suspend the pericardium after cutting open, and establish cardiopulmonary bypass after heparinization. Then for patients with patent ductus arteriosus, cut open pulmonary artery, explore and suture artery catheter with patches under direct vision, and suture pulmonary artery. For patients with atrial septal defect and ventricular septal defect, cut open the right atrium, repair the defect with polyester flake of the size matched, close the incision after gas inside completely drained out [3]. After the above steps completed, rewarm the patient and balance blood volume, stop cardiopulmonary bypass, neutralize heparinization, place thoracic drainage tube conventionally after suturing the pericardium, and close the wound by layer [4].

The study group was given traditional surgical treatment carried out as follows: inject heparin at a dose of 100 U/kg after intravenous puncture, give additional injection every hour during the treatment with 1/4 to 1/3 of the total dosage [5]. Then for patients with patent ductus arteriosus, insert catheter into descending aorta through femoral vein antegrade, place a spring embolus of the sized matched the defect into the designated position through the catheter, round three circles in the side near aorta and one circle in the side near pulmonary artery, perform angiography of aortic arch 15 min later to determine the position and plugging effect of spring embolus, release the spring embolus, remove the catheter and compress for hemostasis [6]. For patients with atrial septal defect, insert a hard guidewire into the left superior pulmonary vein, send the sheath to the left atrium, insert a suited occluder into the left atrium through the sheath by fluoroscopy, withdraw the occluder after opening the left atrium umbrella, fix the guidewire and withdraw the sheath, opening the right atrium umbrella, confirm the plugging effect by fluoroscopy and angiography, release the occluder thoroughly after it fixed without movement when push or pull the guidewire moderately, remove the sheath and compress for hemostasis [7]. For patients with ventricular septal defect, insert the pigtail catheter to aorta and left ventricular through the femoral artery or femoral vein, measure the pressure, perform contrast examination to determine the size of the defect and the distance to aortic valve, construct arterial orbit after careful exploration, send long sheath to the right atrium through the femoral vein and connect it with the right atrial duct, insert into the aortic arch then [8], deliver the exchange guidewire and the right crown catheter to the left ventricular tip through the arterial end, remove the exchange guidewire and send the occluder to the designated position through the delivery system, confirm the location by fluoroscopy and angiography, insert the occluder into the ventricular septal defect in its waist, remove the long sheath backward slightly, release the right disk, observe the location and effect of occlusion again by angiography, withdraw the sheath and catheter if expected effect was achieved, and compress for hemostasis [9].

Observation indexes

The success rate, incidence of complications and levels of serum inflammatory factor were selected as the observation indexes. It was regarded as success if the plugging was confirmed in postoperative reexamination. The complications included infection, pleural effusion and pneumothorax. And serum inflammatory factors included C-reactive protein, IL-6, IL-8 and TNFα, which were measured by 7170S automatic biochemical analyzer manufactured by a Japanese company HITACHI.

Statistical analysis

All statistical analyses were processed with SPSS 17.0 software package. Quantitative data were expressed as Mean ± Standard Deviation, and t test was performed. Enumeration data were expressed as percentage and chi-square test was performed. A p-value smaller than 0.05 refers to statistical significance.

Table 1. *Comparison of success rate and incidence of complications between two groups.*

Groups	n	Success rate (%)	Incidence of complications			
			Infection	Pleural effusion	Pneumothorax	Incidence (%)
Control group	40	97.5	3	1	2	15
Study group	40	100	0	1	2	7.5
^{2}		2.53	7.79	0.00	0.00	2.81
P		0.112	0.005	1.000	1.000	0.093

Results

Comparison of success rate and incidence of complications between two groups

The success rate of the study group was 100%, and the incidence of complications was 7.5%. The success rate of the control group was 97.5%, and the incidence of complications was 15%. The difference between the two groups was not statistically significant (Table 1).

Comparison of serum inflammatory factors between two groups

The levels of serum inflammatory factors had no significant difference between the two groups before treatment. As those levels increased in different extent after treatment, the levels were significantly lower in the study group than in the control group (Table 2).

Table 2. *Comparison of serum inflammatory factors between two groups.*

Groups	C-reactive protein (mg/L)		IL-6 (ng/L)		IL-8 (ng/L)		TNFα (ng/L)	
	Before	After	Before	After	Before	After	Before	After
Control group	15.24 ± 1.06	22.37 ± 1.03	14.33 ± 1.07	21.24 ± 1.06	12.88 ± 1.02	16.45 ± 1.05	10.20 ± 1.10	16.94 ± 1.06
Study group	15.25 ± 1.05	17.89 ± 1.01	14.35 ± 1.05	17.38 ± 1.02	12.90 ± 1.04	14.39 ± 1.01	10.25 ± 1.07	14.28 ± 1.08
t	1.00	8.23	1.00	8.22	1.00	8.21	1.00	8.21
P	0.999	0.035	0.999	0.037	0.999	0.042	0.994	0.040

Discussions

Congenital heart disease is the most common congenital disease in the world. The number of patients is 28% of all congenital malformations and still on the rise, which has attracted the attention of the medical profession. Surgery is the most effective treatment for patients with congenital heart disease. Almost all congenital heart disease can be treated by surgery, especially with the increasing of clinical data and the improvement of clinicians' skills [10]. Interventional therapy is a new treatment between surgical and internal medicine, including vascular intervention and non-vascular intervention, which has become a treatment of minimal wound for lesion location after clinical verification more than 30 years. For the treatment of congenital heart disease, interventional therapy can reduce the damage to patients sharply and improve the effect of rehabilitation after surgery on the one hand, and meet patients' clinical needs better by high success rate up to 100% on the other hand.

In this study, randomized controlled trials were conducted to investigate the clinical efficacy of interventional therapy and traditional surgical treatment for congenital heart disease. The results showed that in the study group the success rate was 100%, the incidence of complications was 7.5%, while in the control group 97.5% and 15% correspondingly, the success rate of the study group was higher than the control group, and the incidence of complications of the study group was lower than the control group, but there was no significant difference between the two groups ($P>0.05$); the levels of serum inflammatory factors had no significant difference between the two groups before treatment, as those levels increased in different extent after treatment, the levels was significantly lower in the study group ($P<0.05$). The results showed that the effect of intermediary treatment in congenital heart disease was better, and the stress response caused was smaller, compared with traditional surgery. It is believed that there were significant differences in the success rate and incidence of complication between interventional therapy and surgical therapy, which cannot be drawn from this study. The reason presumably lies in that clinicians' skill has been obviously enhanced with the improvement of surgical experience, which provided a strong guarantee for the treatment to achieve ideal curative effect. And the advantage of traditional surgery is mainly to deal with complex congenital heart disease types, such as tetralogy of Fallot, pulmonary artery atresia, double outlet right ventricle, transposition of the great arteries, dysplasia of left ventricle, dysplasia of right ventricle, total anomalous pulmonary venous connection, complete type endocardial cushion defect, and interrupted aortic arch [11].

However, the safety of traditional surgery is obviously less than that of interventional therapy because of performed under direct vision. In addition, the acute inflammatory response caused by stress response cannot be ignored for the rehabilitation of patients with congenital heart disease. Local tissue injury was more serious under traditional surgery, which makes C-reactive protein, IL-6, IL-8 and TNFα rise much higher than interventional therapy after treatment, and highlights the advantages of interventional therapy for minimally invasive [12]. However, besides it's not as effective as traditional surgery in treating complex congenital heart disease, the high cost is indeed a serious problem, especially for areas where economic developed poorly in China. There is still a long wait for the popularization of interventional therapy. In conclusion, interventional therapy for congenital heart disease is superior to traditional surgery in terms of success rate, incidence of complications and serum inflammatory factors levels, which should be used as the preferred treatment scheme.

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