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A comparative study of minimally invasive right thoracic incision and traditional incision in patients with mitral valve disease.

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Abstract

Objective: To compare the different clinical effects of minimally invasive right thoracic incision and traditional incision on the treatment of patients with mitral valve disease.
Methods: Eighty patients with mitral valve disease were randomly divided into traditional group (n=40) and minimally invasive group (n=40). The clinical indexes during and after operation were compared between the two groups.
Results: Compared with the traditional group, the aortic cross clamp time, the time of cardiopulmonary bypass and the intraoperative blood loss were significantly decreased in the minimally invasive group, which were significantly lower than those in the traditional group (P<0.05).
Conclusion: With significant clinical effect and large clinical advantage, the minimally invasive right thoracic incision has a greater improvement effect than traditional incision for mitral valve treatment. It is worthy of further promotion in the clinical application.

Keywords: Minimally invasive right small incision, Traditional incision, Mitral valve disease.

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Introduction

Mitral valve disease (MVD) is a common valve disease in cardiovascular diseases, which can induce atrial fibrillation, thrombosis, cerebral infarction and other complications, seriously endangering the health and life quality of people [1,2]. Most patients require surgery for treatment. In the past, the treatment of MVD applied traditional median thoracic incision. Although it had good exposure and treatment effect, such incision led to large trauma with various postoperative complications, which caused a certain impact on the life quality after surgery. With the continuous improvement and development of minimally invasive techniques, minimally invasive mitral valve surgery (MIMVS) has been widely used in the MVD. MIMVS has become a viable alternative to traditional sternotomy. Compared with the traditional mitral valve replacement (MVR), MIMVS has the maximal reduction of surgical trauma and postoperative pain on the premise of ensuring curative effect of the operation, which shortens the recovery time of patients and meets the aesthetic requirements [3-5]. Based on the case–control analysis, this study compared the clinical results and postoperative short and moderate-term complications of minimally invasive right thoracic incision and traditional incision in the treatment of MVD. Besides, a comprehensive evaluation was made for the safety and clinical efficacy of minimally invasive right thoracic incision in the treatment of MVD.

Clinical Data and Methods

Data

Eighty patients with MVD who were treated in our hospital between March 2013 and March 2015 were selected as the subjects, where 40 patients in traditional group included 33 cases with MVR and 7 cases with MVP, while 40 patients in minimally invasive group included 32 cases with MVR and 8 cases with MVP.

Inclusion criteria: (1) All the patients included in the study were diagnosed based on their preoperative history, signs, ECG, chest CT, color Doppler echocardiography, ventricular wall motion analysis and arterial blood gas analysis. All patients with the age over 45 years old received conventional coronary angiography to exclude coronary heart disease. Preoperative cardiac function of patients was classed into grade I to IV based on NYHA. (2) There were no significant differences in age, sex, height, body weight, body surface area, cardio-thoracic proportion, pathogenesis of mitral valve disease, pathological type, complication, grade of heart function and surgical approach (P>0.05). (3) The patients were informed and the study was approved by the Ethics Committee.

Exclusion criteria: preoperative coronary heart disease, liver dysfunction, chronic renal insufficiency, cerebral embolism, cerebrovascular disease, cardiogenic shock, chronic obstructive pulmonary emphysema, cancer, peripheral vascular disease,

suppurative brain abscess, kidney/spleen embolism, history of cardiac surgery, chest surgery history, aortic valve disease, left atrial thrombus, mental illness history.

Surgical approach

The traditional group used traditional median incision thoracotomy for mitral valve surgery. Patients in minimally invasive group took supine position and received invasive monitoring of arterial blood pressure and conventional intravenous plus inhalational anesthesia with jugular vein catheterization. Anesthetists applied percutaneous puncture for right jugular vein catheterization (Edward 16-20Fr) as the drainage tube of superior vena cava, making the head end at the right atrial entrance of superior vena cava. Incision was performed at the fourth intercostal papilla skin between the right anterior axillary line and midclavicular line into the chest. After chest open, the right lung collapsed with left single lung ventilation. Then soft tissue protective cover and chest wall retractor was used. With 2-3 cm incision at the right or left inguinal region, femoral artery and vein were isolated for purse suture. About 1.0 cm incision at the third intercostal of right midaxillary line was made for placing aortic occlusion clamp (Chitwood). Incision at the fifth intercostal of right midaxillary line was made for placing the left ventricle drainage tube and pericardium traction line. Meanwhile, pipeline was placed for continuous low flow of CO_2 after incision of right atrium. Purse suture was performed at the ascending aorta root and cardioplegia perfusion needle was inserted. When the aorta blocked, the anterograde of HTK cardioplegia perfusion was performed, followed by suturing the atrial septum and right atrium, and placing temporary pacing wire on the right ventricular surface. After the exhaust of left heart, ascending aorta was opened, and gradually the body circulation was stopped with hemostasis and closing chest [6,7].

Statistical analysis

Quantitative variables were expressed as mean ± standard deviation ($\bar{\chi} \pm S$) and classified variables as rate. Quantitative variables of two groups were compared with t-test and classification data used $\chi 2$ test. SPSS22.0 statistical software was applied for statistical analysis with $P<0.05$ as statistically significant.

Results

Due to the complexity and cumbersome steps of minimally invasive surgery, the time of operation (250.2 ± 59.3 *vs.* 231.9 ± 89.2 min, P=0.283) and the setting time of cardiopulmonary bypass (36.2 ± 9.8 *vs.* 33.6 ± 6.7 min, P=0.170) was longer than that in the traditional group without significant difference. The auto-rebeat rate of heart in minimally invasive group was higher (90% *vs.* 75%, P=0.077), which might be associated with HTK cardiac perfusion fluid without significant difference. Minimally invasive group had lower perfusion flow (2.3 ± 1.2 *vs.*2.4 ± 0.9 l/(m^2.min), P=0.674) and higher mean perfusion pressure (66.1 ± 10.2 *vs.* 64.2 ± 5.3 mmHg, P=0.300), mainly caused by several patients with thin arteria femoralis who had intraoperative spasm. After treatment, the events had no influence on the operation without significant difference. Considering the difficulty and complexity of operation, the time of cardiopulmonary bypass (159.3 ± 50.1 *vs.* 121.2 ± 65.3 min, P=0.004) and the aortic cross clamp time (89.3 ± 28.2 *vs.* 56.8 ± 19.2 min, P<0.001) in minimally invasive group was significantly higher than that in the control group. Besides, minimally invasive group had small trauma and less intraoperative blood loss (257.1 ± 125.2 *vs.* 436.1 ± 159.9 ml, P<0.001, Table 1).

Table 1. Comparison of intraoperative indexes in patients with mitral valve disease ($\bar{\chi} \pm S$).

Parameters	Minimally invasive group (n=40)	Traditional Group (n=40)	Statistics	*P* value
Time of operation (min)	250.2 ± 59.3	231.9 ± 89.2	—	0.283
Setting time of extracorporeal circulation (min)	36.2 ± 9.8	33.6 ± 6.7	—	0.170
Extracorporeal circulation time (min)	159.3 ± 50.1	121.2 ± 65.3	2.928	0.004
Aortic cross clamp time (min)	89.3 ± 28.2	56.8 ± 19.2	—	0.001
Auto-rebeat rate of heart (%)	36 (90.0)	30 (75.0)	3.117	0.077
Intranperative perfusion flow rate (l/(m^2.min))	2.3 ± 1.2	2.4 ± 0.9	—	0.674
Intranperative average perfusion pressure (mmHg)	66.1 ± 10.2	64.2 ± 5.3	—	0.300
Intraoperative blood loss (ml)	257.0 ± 125.2	436.1 ± 159.9	—	0.001

Discussion

MIMVS includes sternal and half thoracotomy, minimally invasive right thoracotomy and complete thoracoscopic surgery. In early MIMVS cases, right sternal incision was used and achieved encouraging clinical effects [8-12]. However, this approach has been gradually abandoned because of its potential chest wall instability and persistent pain caused by cartilage resection. And other shortcomings include the need for transection of thoracic internal arteries and the difficulty of switching to the median thoracotomy. Since then, minimally

invasive right thoracotomy has become a common method of MIMVS. This study made a comprehensive evaluation of minimally invasive right lateral incision based in the comparison of the minimally invasive right lateral incision and the traditional median incision in the treatment of MVD. The results of this study show that, compared with the traditional group, the aortic cross clamp time, cardiopulmonary bypass time and intraoperative blood loss in minimally invasive group after treatment decrease significantly with significant difference ($P<0.05$). The results indicate that minimally invasive right lateral incision is an effective technique for the treatment of MVD. Patients with mitral valve disease need active measures to deal with the damage to the human body. Studies have shown that the use of minimally invasive right thoracic incision has a significant improvement in this disease treatment. The application of minimally invasive right thoracic incision for mitral valve disease has a certain degree of superiority in the control of the disease and the guiding significance for disease treatment as an alternative treatment. It can timely take the timing of treatment for patients to provide a more ideal method of treatment. Therefore, the rational and effective treatment can quickly achieve the purpose of cure, which is worth of clinical reference.

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