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Research Article

To Value Ventricular Movement Synchronization of Patients with Mitral Valvular Surgery and Pacemaker by TEE

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ABSTRACT

Objective: Detect synchronization of left and right ventricle after mitral valve surgery by transesophageal echocardiography.

Methods: 33 patients were implanted with temporary pacemaker. At preoperative (T_0), 15 mins (T_1) and 45 mins (T_2) after cardiopulmonary bypass, EF, CO, SR-LV, LVSDt, SR-RV, RVSDt, TAPSE, RVFAC, VTI and V_{max} were measured.

Results: Comparing with indicators at T_0, SR-LV of group pacemaker decreased at T_1, T_2; SR-RV, TAPSE of group pacemaker decreased at T_2; VTI of group pacemaker increased at T_1 and increased at T_2; V_{max} of group pacemaker increased at T_1, T_2. Comparing with indicators at T_0, VTI of group control increased at T_1, T_2;V_{max} of group control increased at T_1, T_2.Comparison of two groups, SR-LV at T_1 of group pacemaker decreased, left ventricular contraction at T_1 decreased; LVSDt at T_1 of group pacemaker increased, left ventricular synchronization decreased; SR-LV,SR-RV at T_2 of group pacemaker decreased; TAPSE at T_2 of group pacemaker decreased, left and right ventricular contraction at T_2 decreased.

Conclusion: Myocardial contraction of left and right ventricular of patients with pacemaker decreased in early stage after mitral valve surgery.

Keywords: Transesophageal echocardiography, Valve surgery, Pacemaker, Myocardial synchronization

Introduction

Valve replacement or plasty are effective treatment for heart valve disease. Postoperative patient with slow heart rhythm and low cardiac output need apply pacemaker. Heart rhythm synchronous movement of systole and diastole is prerequisite to realize pump function, cardiac must ensure synchronism of myocardial diastolic and systolic movements between atria and ventricular, between left and right ventricular, and ventricular segments. Myocardial movement out of synchronicity is closely associated with cardiac insufficiency. Left ventricular segmental myocardial movement synchronization ensured ventricular systolic ejection and diastolic filling, right ventricular synchronous movement also gradually get attention. Ventricular movement is not synchronized by occurrence time which is divided into contraction movement out of synchronization and diastolic movement out of synchronization. We analyzed myocardial contraction movement synchronization of left or right ventricular with pure mitral surgery or combined with tricuspid valve surgery by transesophageal echocardiography (TEE).

Materials and Methods

From March 2015 to September 2015, 33 patients need valve replacement or forming operation were orderly selected, which were first time valvular surgery. Cardiac function grade II~III. Except for (1) patients of either mitral and aortic valve replacement or valvular surgery with coronary artery bypass surgery. (2) patients installed with cardiac pacemaker. (3) patients accepted heart secondary surgery, including coronary stent implantation. (4) patients with severe pulmonary artery pressure. (5) patients with severe liver or kidney or other organ damage. All patients underwent electrocardiogram, echocardiography and coronary angiography examination. 12 cases of male patients, 21 cases of female patients, age range 29 ~ 71 year, average age (52±2) year; weight range 38 ~ 85 kg, average weight

(63±2) kg. 19 cases were pacemaker group, 6 cases of male, 13 cases of female; 14 cases were control group (heart rate more than 90 times/min after valvular operation, temporary pacemakers installed don't need work), 6 cases of male, 8 cases of female.

Patients underwent general anesthesia low temperature cardiopulmonary bypass surgery, monitored blood pressure by radial artery or brachial artery, continuous monitoring of CVP by subclavian or internal jugular vein. Average cardiopulmonary bypass time was (110±4) min, average ascending aorta blocking time was (73±3) min. We installed temporary pacemaker after surgery by implanting epicardial pacemaker leads, connected vitro electrode with temporary pacemaker, parameter settings: mode-DOO, frequency of 90 times/min, output voltage of 5.0 V.9 cases of mitral valve replacement + tricuspid valve forming + atrial fibrillation radiofrequency ablation (MVR+TVP+Maze), 7 cases of pure mitral valve replacement (MVR), 5 cases of mitral valve replacement + tricuspid valve forming (MVR+TVP) , 5 cases of mitral valve forming (MVP), 4 cases of mitral valve replacement + atrial fibrillation radiofrequency ablation (MVR+Maze), 2 cases of mitral valve forming + tricuspid valve forming (MVP+TVP) , 1 case of mitral valve + tricuspid valve forming + atrial fibrillation radiofrequency ablation (MVR+TVP+Maze).11 cases of atrial fibrillation radiofrequency ablation were operated before valvular surgery.18 mechanical valves,6 biological valves, 8 mitral valve forming rings, 13 tricuspid valve forming rings were implanted.

Transesophageal echocardiography (TEE) testing in the operation

Collecting figures at left ventricular short axis section and middle papillary muscle plane through stomach, measuring EF value by applying M-mode EF-Teich method (Figure 1). Left ventricular cardiac output (CO) was measured by applying pulse doppler (PW) (Figure 2 and 3). To avoid mechanical disc acoustic shadow interference, we choosed left ventricular short axis section trough stomach, obtained left ventricular short axis image and right ventricular long axis image. We measured left ventricular and right ventricular myocardial strain rate (SR) and time standard deviation of ventricular myocardium segments movement to peak (SDt) (Figure 4-7), and right ventricular whole myocardium movement velocity index (TAPSE, RVFAC) (Figure 8 and 9). By continuous doppler (CW) to determined right ventricular outflow tract image,

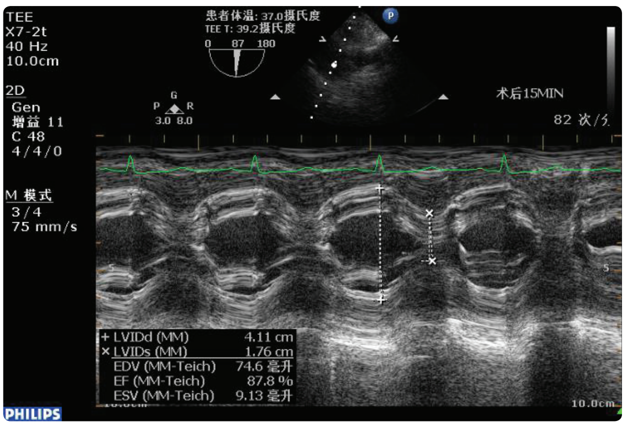

Figure 1: Measure of left ventricular EF value (M-Mode, %).

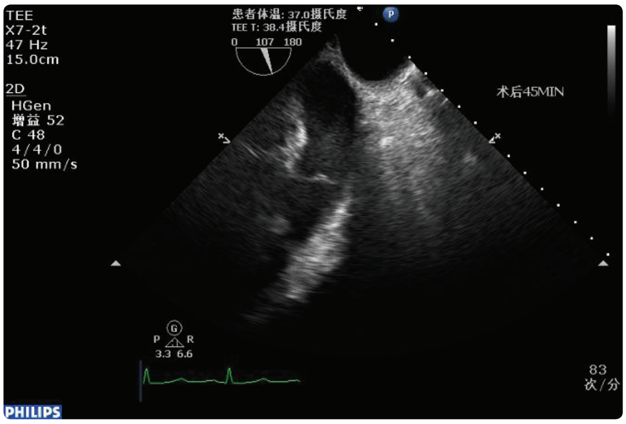

Figure 2: Measurement of left ventricular outflow tract (LVOT).

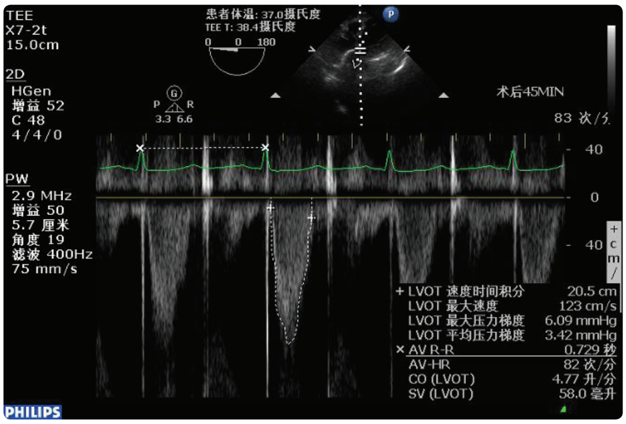

Figure 3: Determination of velocity time integral (VTI_{LVOT}) of left ventricular outflow tract (LVOT) blood flow, combined with heart rate, left ventricular CO was calculated (L/min).

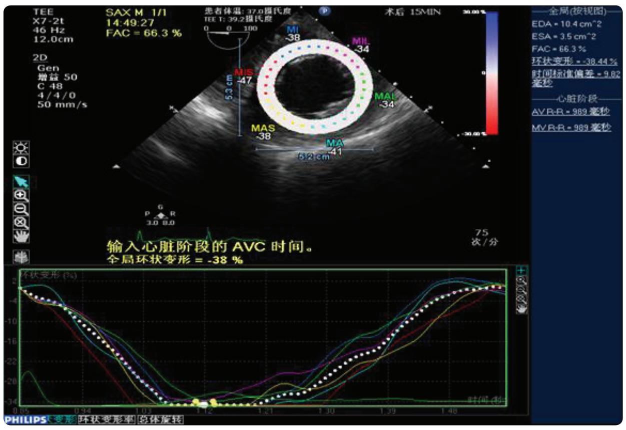

Figure 4: Measurement of left ventricular strain rate (SR,%).

we measured VTI and maximum velocity at 1cm below pulmonary valve (Figure 10). ECG was connected when images were collected, we collected dynamic images of 3~5 cardiac cycles at stable heart rate when splitting sternum (T_0), 15 min after cardiopulmonary bypass stop (T_1), 45 min after cardiopulmonary bypass stop (T_2). Images were stored in hard disk for processing and analysis. All parameters were taken average value of three consecutive cardiac cycles.

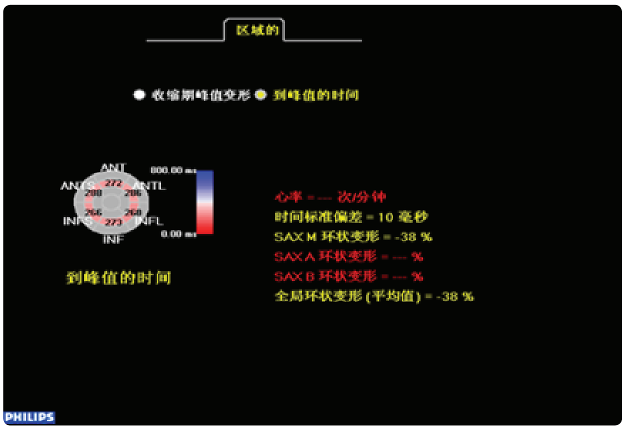

Figure 5: Measurement of time standard deviation of left ventricular six myocardial segments movement to peak (SDt, ms).

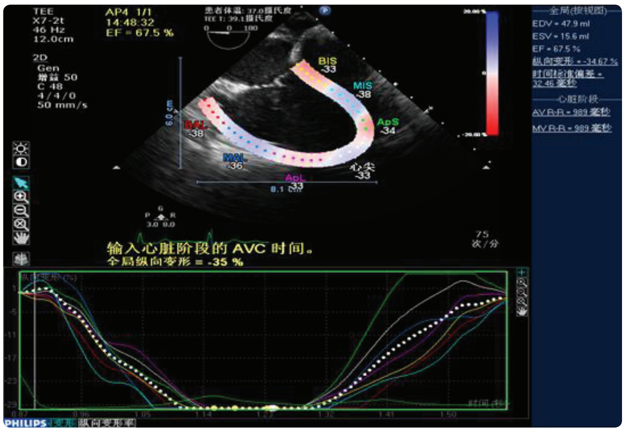

Figure 6: Measurement of right ventricular strain rate (SR,%).

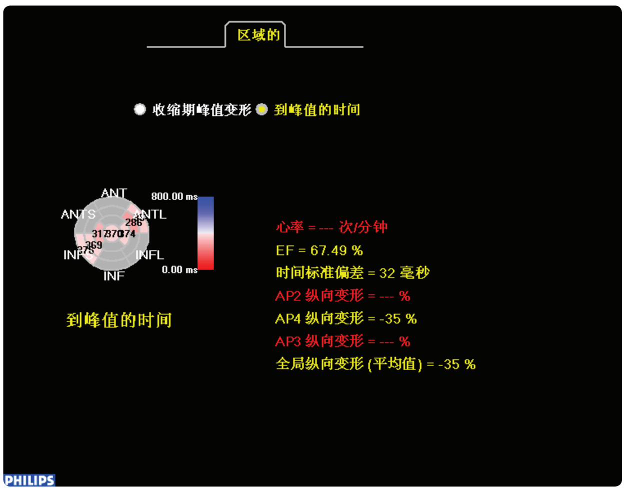

Figure 7: Measurement of time standard deviation of right ventricular seven myocardial segments movement to peak (SDt, ms).

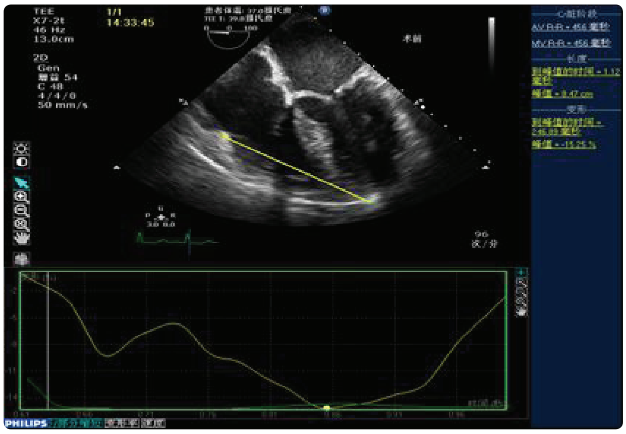

Figure 8: Measurement of right ventricular tricuspid annular plane systolic excursion (TAPSE, mm).

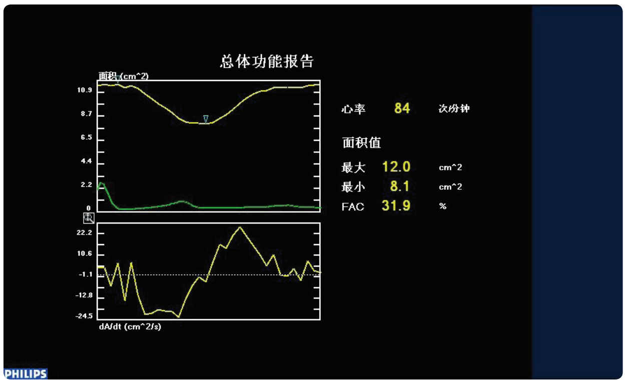

Figure 9: Measurement of right ventricular fractional area change (RVFAC, %).

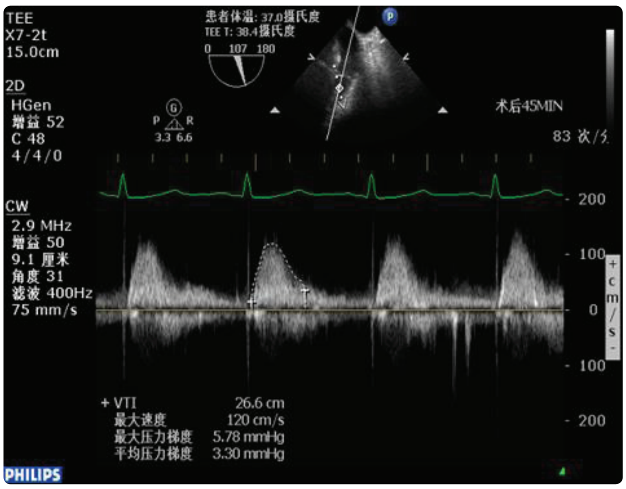

Figure 10: Measurement of velocity time integral (VTI, cm) and maximum velocity (cm/s) of pulmonary valve blood flow.

Statistical analysis

Using SPSS19.0 statistical software, normality measurement data were showed with mean ± standard deviation $\bar{x}$±s. Normal distribution data were compared in groups using paired *t* test, between groups using independent sample *t* test, $P<0.05$ showed statistically significant difference.

Results

General characteristics

33 patients undergoing mitral or tricuspid valve surgery had no perivalvular leakage; 11 patients with atrial fibrillation radiofrequency ablation restored sinus rhythm. The age, BSA, preoperative LVEF, blocking time of group P and group C had no significant difference ($P>0.05$), CPB time of group P is longer than group C ($P<0.05$) (Table 1).

Hemodynamic parameters in group P

There was no significant difference in HR, MAP and LVEF among T_0, T_1, T_2 in group P. CVP at T_1 was higher than that at T_0 ($p<0.01$); CO at T_1 was higher than that at T_0 ($p<0.01$), CO at T_2 was higher than that at T_0 ($p<0.05$); CI at T_1 was higher than that at T_0 ($p<0.01$), CI at T_2 was higher than that at T_0 ($p<0.05$) (Table 2).

Myocardial synchronization movement in group P

SRLV at T_1, and SRLV T_2 were lower than that at T_0 in group P ($p<0.05$); TAPSE at T_2 was lower than that at T_0 in group P ($p<0.01$); SR-RV at T_2 was lower than that at T_0 in group P ($p<0.05$); VTI at T_1 was higher than that at T_0 in group P ($p<0.01$), and VTI at T_2 was higher than that at T_0 in group P ($p<0.05$); The maximum velocity at T_1 and T_2 were higher than that at T_0 in group P ($p<0.01$) (Table 3).

K^+ at T_2 was higher than that at T_0 in group P ($P<0.05$); Ca^{++}Hb at T_2 was higher than that at T_0 in group P ($P<0.01$); Hb at T_2 was lower than that at T_0 in group P ($P<0.01$) (Table 4).

Hemodynamic parameters in group C

There was no significant difference in HR, MAP, CI and LVEF among T_0, T_1, T_2 in group C ($p>0.05$). CVP at T_1 was higher than at T_0 ($p<0.01$), CVP at T_2 was higher than at T_0 ($p<0.05$); CO at T_1 was higher than T_0 ($p<0.05$) (Table 5).

Myocardial synchronization movement in group C: VTI at T_1 and T_2 were higher than that at T_0 in group C ($p<0.05$); The maximum velocity at T_1 and T_2 were higher than that at T_0 in group C ($p<0.01$) (Table 6).

K^+ at T_2 was higher than that at T_0 in group C ($P<0.01$); Hb at T_2 was lower than that at T_0 in group C ($P<0.01$) (Table 7).

Hemodynamic parameters comparison between two groups

MAP, CO, CI at T_0, T_1 and T_2 had no significant difference ($P>0.05$); HR at T_2 in group P was higher than that in group C ($P<0.05$); CVP at T_0 in group P was higher than that in group C ($P<0.05$); LVEF at T_1 in group P was lower than that in group C ($P<0.05$) (Table 8).

Table 1: General characteristics of patients in two groups ($\bar{x}$ ±s).

	Group P\ (n=19)	Group C (n=14)	*P*
Age (year)	62.05±3.07	64.96±2.58	0.494
BSA (m²)	1.64±0.046	1.69±0.04	0.421
Preoperative LVEF (%)	63.26±1.13	64.36±0.89	0.478
CPB time (min)	117.32±4.88	99.57±4.33	0.014
Blocking time (min)	78.68±4.83	65.64±4.03	0.058

Table 2: Hemodynamic parameters (T_0, T_1, T_2) ($\bar{x}$±s in group P (n=19 cases).

	T_0	T_1	T_2	*P*
HR (per minute)	87.58±4.01	88.53±4.01	92.68±1.16	a=0.828 b=0.229
MAP (mmHg)	77.84±2.90	72.89±1.75	76±2.74	a=0.153 b=0.647
CVP (cm)	7.21±0.63	9.68±0.55	8.95±0.80	a=0.005 b=0.097
CO (L/min)	3.08±0.26	4.44±0.24	3.99±0.27	a=0.001 b=0.020
CI ($Lmin^{-1}m^{-2}$)	1.91±0.17	2.74±0.17	2.45±0.16	a= 0.002 b=0.029
LVEF (%)	58.71±2.34	57.66±2.43	56.84±2.42	a=0.758 b=0.583

a is T_1:T_0; b is T_2:T_0.

Table 3: Myocardial synchronization movement parameters (T_0, T_1, T_2) ($\bar{x}$±s) in group P (n=19 cases).

	T_0	T_1	T_2	*P*
SR-LV (%)	15.16±1.35	10.58±1.02	10.79±1.12	a=0.010 b=0.018
LVSDt (ms)	76.84±7.73	98.74±10.22	91.84±8.02	a=0.096 b=0.187
TAPSE (mm)	17.36±1.55	13.81±1.178	12.04±0.75	a=0.076 b=0.004
RVFAC (%)	34.95±1.96	33.84±2.12	30.69±2.01	a=0.703 b=0.138
SR-RV (%)	13.74±1.03	13.17±0.98	10.58±0.88	a=0.694 b=0.026
RVSDt (ms)	90.05±8.74	85.16±8.67	88.32±9.25	a=0.693 b=0.892
VTI (cm)	12.41±0.91	17.75±1.34	16.71±1.35	a=0.003 b=0.013
Vmax (cm/s)	70.99±4.63	112.66±9.57	105.98±7.90	a=0.000 b=0.001

Note: SR-LV: Strain Rate of Left Ventricle; LVSDt: Standard Deviation of time of Left Ventricular; TAPSE: Tricuspid Annular Plane Systolic Excursion; RVFAC: Fraction of Area Change in Right Ventricular; SR-RV: Strain Rate of Right Ventricle; RVSDt: Standard Deviation of time of Right Ventricular; VTI: Velocity Time Integral of pulmonary valve blood flow; V_{max}: Maximum Velocity of pulmonary valve blood flow.

a is T_1:T_0; b is T_2:T_0.

Myocardial synchronization movement parameters between two groups

SR-LV at T_1 in group P was lower than that at T_1 in group C ($P<0.01$), SR-LV at T_2 in group P was lower than that at T_2 in group C ($P<0.05$); LVSDt at T_1 in group P was higher than that at T_1 in group C ($P<0.05$); TAPSE at T_2 in group P was lower than that at T_2 in group C ($P<0.01$); SR-RV at T_2 in group P was lower than that at T_2 in group C ($P<0.05$) (Table 9).

Ion (K^+, Ca^{++}) and hemoglobin comparison between two groups at T_0, T_2 had no significant difference (*P*>0.05) (Table 10).

Discussion

We selected patient with mitral valve disease, shortened cardiac arrest time and protected myocardial against injury during valvular

Table 4: The change of ion and hemoglobin (T_0, T_2) **($\bar{x}\pm s$)** in group P (n=19 cases).

	T_0	T_2	*P*
K^+ (mmol/L)	4.07±0.13	4.66±0.18	b=0.011
Ca^{++} (mmol/L)	1.15±0.01	1.22±0.02	b=0.004
Hb (g/L)	14.95±0.44	9.65±0.32	b=0.000

b is T_2:T_0.

Table 5: hemodynamic parameters (T_0, T_1, T_2) **($\bar{x}\pm s$)** in group C (n=14 cases).

	T_0	T_1	T_2	*P*
HR per minute	82±4.52	91.71±3.18	85.43±2.74	a=0.090 b=0.522
MAP (mmHg)	75.86±2.83	75.21±2.50	75.21±2.48	a=0.866 b=0.866
CVP (cm)	5.36±0.45	9.07±0.85	7.71±0.83	a=0.001 b=0.020
CO (L/min)	3.51±0.42	4.82±0.44	4.33±0.25	a=0.040 b=0.103
CI ($Lmin^{-1}m^{-2}$)	2.10±0.27	2.85±0.27	2.58±0.17	a=0.063 b=0.157
LVEF (%)	59.66±3.23	67.17±3.59	60.46±3.15	a=0.132 b=0.862

a is T_1:T_0; b is T_2:T_0.

Table 6: myocardial synchronization movement parameters (T_0, T_1, T_2) **($\bar{x}\pm s$)** in group C (n=14 cases).

	T_0	T_1	T_2	*P*
SR-LV (%)	15.57±1.70	17.79±2.42	14.96±1.68	a=0.461 b=0.799
LVSDt (ms)	72.5±10.19	61.36±9.21	78.5±12.77	a=0.425 b=0.716
TAPSE (mm)	17.21±1.51	15.83±1.50	15.64±1.01	a=0.523 b=0.396
RVFAC (%)	38.06±3.18	38.36±3.47	35.06±2.75	a=0.951 b=0.481
SR-RV (%)	14.36±1.44	13.64±1.89	13.47±0.77	a=0.766 b=0.592
RVSDt (ms)	81.64±13.07	78.79±8.65	99.57±20.32	a= 0.857 b=0.465
VTI (cm)	12.98±1.30	20.39±2.44	18.13±1.41	a=0.012 b=0.012
Vmax (cm/s)	71.09±7.23	117.39±14.28	104.41±7.62	a=0.008 b=0.004

a is T_1:T_0; b is T_2:T_0.

Table 7: The change of ion and hemoglobin (T_0, T_2) **($\bar{x}\pm s$)** in group C (n=14 cases)

	T_0	T_2	*P*
K^+ (mmol/L)	3.97±0.10	4.87±0.18	b=0.000
Ca^{++} (mmol/L)	1.15±0.01	1.18±0.03	b=0.234
Hb (g/L)	14.01±0.36	9.22±0.40	b=0.000

b is T_2:T_0.

Table 8: hemodynamic parameters (T_0, T_1, T_2) **($\bar{x}\pm s$)** of group P compared with group C.

		Group P (n=19)	Group C (n=14)	*P*
HR (per minute)	T_0	87.58±4.01	82.00±4.52	0.365
	T_1	88.53±4.01	91.71±3.18	0.343
	T_2	92.68±1.16	85.43±2.74	0.012
MAP (mmHg)	T_0	77.84±2.90	75.86±2.83	0.637
	T_1	72.89±1.75	75.21±2.50	0.439
	T_2	76±2.74	75.21±2.48	0.839
CVP (cm)	T_0	7.21±0.63	5.36±0.45	0.033
	T_1	9.68±0.55	9.07±0.85	0.534
	T_2	8.95±0.80	7.71±0.83	0.304
CO (L/min)	T_0	3.08±0.26	3.51±0.42	0.369
	T_1	4.44±0.24	4.82±0.44	0.420
	T_2	3.99±0.27	4.33±0.25	0.376
CI ($Lmin^{-1}m^{-2}$)	T_0	1.91±0.17	2.10±0.27	0.544
	T_1	2.74±0.17	2.85±0.27	0.708
	T_2	2.45±0.16	2.58±0.17	0.619
LVEF (%)	T_0	58.71±2.34	59.66±3.23	0.806
	T_1	57.66±2.43	67.17±3.59	0.030
	T_2	56.84±2.42	60.46±3.15	0.361

Table 9: myocardial synchronization movement parameters (T_0, T_1, T_2) **($\bar{x}\pm s$)** of group P (n=19 cases) compared with group C (n=14 cases).

		Group P (n=19)	Group C (n=14)	*P*
SR-LV (%)	T_0	15.16±1.35	15.57±1.70	0.849
	T_1	10.58±1.02	17.79±2.42	0.005
	T_2	10.79±1.12	14.96±1.68	0.040
LVSDt (ms)	T_0	76.84±7.73	72.5±10.19	0.732
	T_1	98.74±10.22	61.36±9.21	0.014
	T_2	91.84±8.02	78.5±12.77	0.361
TAPSE (mm)	T0	17.36±1.55	17.21±1.51	0.946
	T_1	13.81±1.18	15.83±1.50	0.292
	T_2	12.04±0.75	15.64±1.01	0.006
RVFAC (%)	T_0	34.95±1.96	38.06±3.18	0.386
	T_1	33.84±2.12	38.36±3.47	0.251
	T_2	30.69±2.01	35.06±2.75	0.198
SR-RV (%)	T_0	13.74±1.03	14.36±1.44	0.721
	T_1	13.17±0.98	13.64±1.89	0.814
	T_2	10.58±0.88	13.47±0.77	0.025
RVSDt (ms)	T_0	90.05±8.74	81.64±13.07	0.582
	T_1	85.16±8.67	78.79±8.65	0.229
	T_2	88.32±9.25	99.57±20.32	0.913
VTI (cm)	T_0	12.41±0.91	12.98±1.30	0.337
	T1	17.75±1.34	20.39±2.44	0.164
	T_2	16.71±1.35	18.13±1.41	0.094
Vmax (cm/s)	T_0	70.99±4.63	71.09±7.23	0.572
	T_1	112.66±9.57	117.39±14.28	0.483
	T_2	105.98±7.90	104.41±7.62	0.362

Table 10: The change of ion and hemoglobin (T_0, T_2) **($\bar{x}$±s)** of group P (n=19 cases) compared with group C (n=14 cases)

		Group P (n=19)	Group C (n=14)	P
K^+ (mmol/L)	T_0	4.07±0.13	3.97±0.10	0.576
	T_2	4.66±0.18	4.87±0.18	0.417
Ca^{++} (mmol/L)	T_0	1.15±0.01	1.15±0.01	0.572
	T_2	1.22±0.00	1.18±0.03	0.242
Hb (g/L)	T_0	14.95±0.44	14.01±0.36	0.131
	T_2	9.65±0.32	9.22±0.40	0.406

surgery. Keep as far as possible mitral valve and tricuspid valve and valve device, first consider angioplasty, then valve replacement, especially valve formation in ticuspid valve surgery primarily. Singh, et al. [1] reported mortality associated with valve and reoperation rate had no obvious difference between patients after tricuspid valve forming and valve replacement, but forming can reduce potential thrombosis related complications, and improve overall survival rate postoperative 10 years.

Myocardial fibers are composition of ring, longitudinal and oblique line of three kinds of fibers, myocardial motion including radial motion, longitudinal motion, circular motion and rotation movement in four directions. Longitudinal fibers accounting for about 70% of myocardium dominates myocardial longitudinal axial plane movement, what's most important to ventricular systolic motion [2,3]. We choosed right ventricular long axis longitudinal motion, selected left ventricular papillary muscle short axis radial motion for detecting, avoided interference of implanted mechanical disc to ultrasound. Strain (S) refers to myocardial muscle change in length after force, Strain rate (SR) refers to strain per unit time, refers to rate of deformation, two parameters reflect myocardial systolic function. An animal experiment confirmed that local strain reflected local ejection fraction, overall strain reflected overall ejection fraction [4]. SR reflects myocardial contraction performance, can reflect partial and overall cardiac systolic function, Sevimli, et al. [5] study showed right ventricular long axis of S and SR can be used to evaluate right ventricular systolic function. The greater left and right ventricular myocardial global cyclic strain rate (SR), the stronger left and right ventricular systolic motion, SR can quantitatively evaluate ventricular systolic function [6]. The smaller time standard deviation of left and right ventricular myocardial paragraphs movement to peak, namely the smaller standard deviation of peak time (SDt), left and right ventricular myocardial motion more tend to synchronize, the movement is more coordinated. Whole right ventricular myocardial motion velocity index (TAPSE, RVFAC) reflect right ventricular systolic function [7]. The greater right ventricular tricuspid annulus systolic displacement and right ventricular area change fraction, the stronger right ventricular contraction. The greater time velocity integral (VTI) and maximum velocity of blood flow of pulmonary valve, the stronger right ventricular contractions and pulmonary artery pressure improvement compared with preoperative.

Compared with patients in group P, heart beated stronger at T_1, can lead to increased CVP. CO and CI rised after surgery, left ventricular systolic function enhanced. Myocardial synchronization in heart, Rudski, et al. [8] and other scholars published adult right ventricular ultrasound guide in 2010, systolic function index RVFAC reference range for 49±14 (%); TAPSE reference range for 23±7 (mm). Preoperative RVFAC of our 33 patients were 20-52.4 (%), the mean within the scope of the reference. All TAPSE were between 7-30.2 (mm), the mean within the reference range. SRLV of group P reduced after valvular surgery at T_2, left ventricular movement function reduced. TAPSE of group P reduced after valvular surgery at T_2, right ventricular movement function reduced. VTI and V_{max} of group P increased after valvular surgery at T_1, T_2, the velocity of blood flow under pulmonary valve increased.

Compared with patients in group C, CVP increased at T_1, may be related with improved cardiac function of postoperative patients. CO rised after surgery at T_1, left ventricular systolic function enhanced. In myocardial synchronization, VTI and V_{max} of group C increased after valvular surgery at T_1,T_2, the velocity of blood flow under pulmonary valve increased. Comparison between two groups patients, cardiopulmonary bypass time of group P patients were higher than that of group C, there were cardiac conduction system damage probability in group P patients, and related to postoperative autonomous heart rate below 90 times/min needing pacemaker safeguard. Onalan, et al. [9] found cardiopulmonary bypass time was an independent risk factor for pacemaker dependence, which is consistent with our study. CVP of group P were higher than that of group C at T_0 ($p<0.05$). There were no obvious differences in HR, MAP, CO, CI, LVEF before valve surgery ($p>0.05$). LVEF of group P were lower than that of group C at T_1 ($p<0.05$). HR of group P were higher than that of group C at T_2 ($p<0.05$). SRLV, LVSDt of left ventricular and TAPSE, RVFAC, SR-RV, RVSDt, VTI and V_{max} of right ventricular in group P were no obvious difference with that in group C at T_0 ($p>0.05$). When two groups were compared at T_1, SRLV of left ventricle in group P were lower than that in group C ($p<0.01$), LVSDt of left ventricle in group P were higher than that in group C ($p<0.05$). TAPSE, RVFAC, SR-RV, RVSDt, VTI and V_{max} of right ventricular in group P were no obvious difference with that in group C ($p>0.05$). Our study suggested left ventricular movement weakened, left ventricular synchronization decreased, while there was no obvious difference in ventricular movement and synchronization at T_1 between group P and group C. At T_2, SRLV of left ventricle in group P were lower than that in group C ($p<0.05$). TAPSE of right ventricle in group P were lower than that in group C ($p<0.01$). SR-RV of right ventricle in group P were lower than that in group C ($p<0.05$). LVSDt of left ventricle and RVFAC, RVSDt, VTI and V_{max} of right ventricular in group P were no obvious difference compared with that in group C ($p>0.05$). Our study suggested left ventricular and right ventricular movement both weakened, while there was no obvious difference in left and right ventricular movement synchronization at T_2 between group P and group C.

In a word, compared with group C, left ventricular motion of group P were abated at extracorporeal circulation stop 15 min, left ventricular synchronization movement decreased. Left ventricular and right ventricular movement of group P were both weakened at extracorporeal circulation stop 45 min. It may be related which CPB (cardiopulmonary bypass) time of group P were longer than that of group C. Postoperative left ventricular myocardial uncoordinated contraction, extended systolic period, shortened left ventricular ejection period, decreased stroke volume and left ventricular ejection fraction. Postoperative right ventricular systolic function abated, and also resulted in decrease of right ventricular ejection fraction.

Testing ventricular myocardial synchronous movement by ultrasonic in operation was rapid, noninvasive and repeatable evaluation. TEE in operation monitored operation in real time, evaluated surgical effects immediately, had specific guidance meaning in guiding extracorporeal circulation management and postoperative care treatment of patients, and predicting cardiac function and postoperative complications such as low cardiac output syndrome, cardiac arrhythmia, left or right heart failure, etc.) of postoperative patients.

Conclusion

Left ventricular myocardial contraction of group pacemaker weakened compared with preoperative patients at extracorporeal circulation stop 15 min, 45 min. Right ventricular myocardial contraction of group pacemaker weakened compared with preoperative patients at extracorporeal circulation stop 45 min. Blood flow velocity under pulmonary valve of group pacemaker increased compared with preoperative patients at extracorporeal circulation stop 15 min, 45 min. Blood flow velocity under pulmonary valve of group control increased compared with preoperative patients at extracorporeal circulation stop 15 min, 45 min. Between patients of group pacemaker and group control, left and right ventricular systolic function and synchronization movement were no significant differences before valve replacement or angioplasty. Left ventricular myocardial contraction of group pacemaker patients weakened compared with group control patients at extracorporeal circulation stop 15 min, 45 min. Left ventricular synchronization movement of group pacemaker patients weakened compared with group control patients at extracorporeal circulation stop 15 min, not harmonious. Left ventricular synchronization movement tended to be coordinated at extracorporeal circulation stop 45 min. Left ventricular and right ventricular myocardial contraction of group pacemaker patients weakened compared with group control patients at extracorporeal circulation stop 45 min. But Left ventricular and right ventricular synchronization were no significant differences between two groups. The study showed hemodynamic disorder caused by valve disease were lifted or reduced after valve operation. Patients intraoperatively installed pacemaker in early postoperative period need drug treatment, long-term cardiac function recovery remains to be seen.

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