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The efficacy of trans-esophageal echo-cardiography in treatment of nonvalvular atrial fibrillation with left atrial appendage occlusion

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Abstract. – OBJECTIVE: To investigate the efficacy of transesophageal echocardiography (TEE) in the treatment of nonvalvular atrial fibrillation with left atrial appendage (LAA) occlusion.

PATIENTS AND METHODS: Forty-nine patients with nonvalvular atrial fibrillation were selected from January 2015 to December 2015 to serve as control group, and 49 patients with nonvalvular atrial fibrillation were selected from January 2016 to December 2016 to serve as observation group. Patients in both groups were treated with LAA occlusion. After su[rgery], patients in control group received 2D-[trans]esophageal echocardiography (2D-TEE), w[hil]e patients in observation group received 3D-T[EE]. LAA diameter, maximum depth, postoperat[ive] parameters, and postoperati[ve comp]lication[s] were compared between tw[o gr]oups.

RESULTS: The maximu[m L]AA dia[me]ter can be measured from differe[nt] angle[s in con]trol group, and maximum [illegible]h o[illegible] mea[sure]d in control group. N[o s]ignifica[nt di]fferences in maximum LAA [diamet]er and m[axim]um depth were found be[tw]een [illegible] groups f[rom] different angles ($p<0.05$). No sig[nific]ant difference in left ventricula[r en]d diastolic [diam]eter (LVEDd), left atrial di[am]eter (LA-d), left [vent]ricular ejection fracti[on (L]VEF), [mit]ral regurgitation volume (MV Reg [illegible] p[illegible]) and pulmonary vein diastolic flow ve[locity (P]Vd) w[ere] found between those [two] grou[ps (]$p<0.0$[5]). The overall occurrence of [pos]topera[tive c]omplications in observation [gr]oup an[d co]ntrol group were 0.00% and 12.[illegible]% respectively, significant difference was f[ound betwee]n those two groups ($p<0.05$).

CONCLUSIONS: Compared with 2D-TEE, the [app]lication of 3D-TEE in treatment of nonvalvular [atr]ial fibrillation with left atrial appendage occlu[si]on is more conducive to the selection of the size of the reservoir, and can reduce the occurrence of postoperative complications.

Key Words

Transesophageal echocardiography, Nonvalvular atrial fibrillation, Left atrial appendage. Transesophageal echocardio[graph]y, Non[valvu]lar atri[al fi]brillation, Left atrial app[enda]ge.

Intro[duc]tion

[N]onvalvular [atr]ial fibrillation is a clinical ar-r[hyth]mia proble[m] with a potential risk of thrombos[is. I]t has b[een] pointed out that[1,2] the emboli of ab[illegible] patients with nonvalvular atrial fibrillation were from atrial appendage (LAA). [Alth]ough long-term use of warfarin can reduce [the occ]urrence of stroke, the poor compliance and tolerance of patients to long-term use of warfarin increases the risk of bleeding. While surgical treatment can cause relatively big trauma, LAA cannot be completely blocked in about 36% of patients, and the success rate of catheter ablation at low- and long-term efficacy is poor[3]. Therefore, percutaneous LAA occlusion has been widely used in the treatment of nonvalvular atrial fibrillation. However, because LAA wall is thin and morphology is not uniform, an accurate assessment should be done during surgery and after surgery to shorten the operation time, reduce the prevalence of complications, and improve patient prognosis[4]. In this study, the efficacies of 2D- transesophageal echocardiography (TEE) and 1D-TEE in treatment of nonvalvular atrial fibrillation with left atrial appendage occlusion were compared with the expectation of providing a reference for late clinical treatment.

Patients and Methods

Patients

Forty-nine patients with nonvalvular atrial fibrillation were selected from January 2015 to De-

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cember 2015 to serve as control group, and another 49 patients with nonvalvular atrial fibrillation were selected from January 2016 to December 2016 to serve as observation group. In the control group, there were 33 males and 16 females, and the age ranged from 35 to 87 years with an average age of 69.38 ± 6.38 years. 31 patients were combined with hypertension, and 19 patients had a history of stroke. In the observation group, there were 36 males and 13 females, and the age ranged from 36 to 89 years with an average age of 68.36 ± 6.13 years. 28 patients were combined with hypertension, and 21 patients had a history of stroke. No significant difference in age, gender, and other basic information were found between the two groups (p<0.05).

Inclusion criteria: 1) patients clinically diagnosed with nonvalvular atrial fibrillation; 2) patients ≥18 years old; 3) patients failed in anticoagulant treatment; 4) patients with warfarin-related contraindications showing adverse reactions; 5) patients who signed informed consent.

Exclusion criteria: 1) patients with left ventricular ejection fraction (LEVF) <40% and New York Heart Association (NYHA) heart fai e grade IV; 2) patients experienced myo infarction or acute myocardial infarction w n 3 months; 3) with spontaneous echo contrast thrombosis in left atrium and LAA; 4) patie with coagulation dysfunction bleedin within 3 months after surge

The study was approv the E Committee of the First Aff te zhou University.

Instrument

The GE Vivid E9 sound system was used. Le in cardiac s were excluded, and LV was measured usi chest ultrasound prob 5S. 3D E and 2D-TEE images were acqui esopha l three-dimensional ul und e 6VT

Op tion od

TE: lesions in valves were excluded and ventr r function was evaluated, followed TEE examination. Using two-dimensional , images of left atrium, LAA, atrial septum an wo valves were acquired from the section of the middle part of esophagus. Mitral regurgitation, pericardial effusion, and pulmonary vein diastolic flow velocity were measured.

3D-TEE: LAA was displayed in a 90° section. 4D-Zoom was used to move LAA into the sampling box under 3D mode. Images of LAA volume in 5 continuous cardiac cycles were stored, and the images were transferred to EchoPac workstation for data analysis. LAA diameter was measured. The distance from the midpoint of the diameter of LAA body to the furthest tip was the depth of LAA. Pos left ventricular end diastolic diamet LVEDd left atrial diameter (LA-d), LE mitral regurgitation volume (MV Reg V), eak and pulmonary vein diastolic velo (PVd) were measured.

Statistical Analysis

SPSS19.0 sof e (Ma atica, Beijing, China s used atisti analysis. Measureme nd count d e processed by t-test χ^2- respective Comparisons among multiple grou ere performed by ANOVA D t-test, p< was considered to be st ically significant.

Results

Comparisons of LAA Diameter Maximum Depth

mum LAA diameter can be measured from different angles in control group, and maximum depth cannot be measured in control group. No significant differences in maximum LAA diameter and maximum depth were found between the two groups from different angles (p<0.05) (Table I for details).

Comparison of Postoperative Parameters

There was no significant difference in LVEDd, LA-d, LVEF, MV Reg V, E peak, and PVd between the two groups (p<0.05) (Table II for details).

Table I. Comparisons of LAA diameter and maximum depth (mm).

Groups	Cases (n)	LAA diameter	Maximum depth
Control group	49	19.99±3.64	—
Observation group	49		
0°		20.73±2.99	27.57±4.57
45°		18.81±2.44	27.08±5.34
90°		19.39±2.47	25.63±5.12
135°		19.65±2.71	24.24±4.41
F-value		1.811	3.158
p-value		0.075	0.057

Table II. Comparison of postoperative parameters.

Groups	Cases (n)	LVEDd (mm)	LA-d (mm)	LVEF (%)	MV Reg V (ml)	E peak (m/s)	PVd (m/s)
Control group	49	47.00±3.91	39.17±5.88	61.78±5.93	3.39±1.70	0.84±0.17	0.53±0.13
Observation group	49	46.87±3.67	39.35±5.01	62.87±6.65	3.87±2.77	0.88±0.19	0.55±0.13
F-value		1.912	1.679	1.615	1.813	1.947	1.89[illegible]
p-value		0.068	0.091	0.190	0.077	0.056	[illegible]

Table III. Comparison of prevalence of complications [n(%)].

Groups	Cases (n)	Reservoir displacement	Pericardial tamponade	Thrombus	Bleeding	[illegible]ke	To[illegible] pr[illegible]alenc[illegible]
Control group	49	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.0[illegible]	[illegible]00)	0 (0.[illegible])
Observation group	49	2 (4.08)	1 (2.04)	1 (2.04)	1 ([illegible]	1 [illegible]	6 ([illegible])
F-value							[illegible]7
p-value							[illegible].020

Comparison of Prevalence of Complications

Overall prevalences of postoperative complications in observation group and control group were 0.00% and 12.24%, respectively, significant differences were found between the two gr[illegible] ($p<0.05$) (Table III for details).

Discussion

An accurate assessment [illegible] the a[illegible]omy of LAA and accurate meas[illegible]ent of [illegible] diameter is very important [illegible]r [illegible] though the conventi[illegible] 2D-T[illegible]n be used to understand the [illegible]ology of [illegible] by multi-slice rotation [illegible] the multi-s[illegible] rotation scan requir[illegible] a longer [illegible]ection time, which cannot b[illegible]erated by so[illegible]tients. So, information [illegible]out th[illegible] anatomy [illegible] LAA cannot be obta[illegible] in a [illegible]t period through 2D-TEE[5,6]. 3D-T[illegible] used [illegible] assist the application [illegible]serv[illegible] 3D-T[illegible] images can display the [illegible]he w[illegible] of reservoir, the location of [illegible]eter in [illegible] heart, and the structure of th[illegible]nding tissue. 3D-TEE images can [illegible] disp[illegible] the front of the reservoir after [illegible]cement, which can reflect the occlusion[7]. [illegible]fore, 3D-TEE is conducive for the development of personalized LAA occlusion. In this study, the efficacies of 2D-TEE and 1D-TEE in treatment of nonvalvular atrial fibrillation with left atrial appendage occlusion were compared with the expectation of providing a reference for late clinical treatment.

I[illegible] study, no [illegible]ficant differences in m[illegible]mum LAA diamete[illegible] and maximum depth w[illegible] found bet[illegible]en the two groups from different angles (p[illegible]05). There are two types of occ[illegible]rs com[illegible]nly used in clinical practice, inclu[illegible] occluder and LAmbre occluder. LAmbre occluders are divided into two types [illegible]ding specially used and conventional used [illegible]. The specially used type is also called small umbrella with big plate type. The openings of small umbrellas were covered by the big plate to complete occlusion. This technique is usually used for multiple lobular LAA with similar diameters. Conventional LAmbre occluders are suitable for most patients[8]. Occlusion using LAmbre occluder is achieved by making the head of trabeculae in atria 1 cm higher than the inner mouth of LAA. Lefort occluder is an umbrella device, and the occlusion was achieved by opening the umbrella and pushing. This device is suitable for single deep LAA. Lefort occluder cannot be used to complete occlusion for LAA with big atria, shallow body, irregular cross section of mouth, and cauliflower shape atria[9]. With the three-dimensional multi-slice reconstruction imaging mode, 3D-TEE can be used to get more clear images of cross-section, which is conducive for the selection of occluder[10]. 3D-TEE can be used to more clearly display the three-dimensional of valves, which is helpful for physicians to find the best puncture point. After puncture, 3D-TEE can also be used to observe the location of the sheath guide wire in LAA and the whole process of occlusion achieved by occluder, which is helpful for the placement of occluder. Also, 3D-TEE can also be used to display the whole body of LAA after the placement of occluder, which in turn avoid the compression on left upper lung vein caused by occluder[11]. The key points of postoperative follow-up of patients with valvular atrial fibrillation are occluder displacement, pericardial tamponade, formation of thrombus, and bleeding. It has been reported[12] that hemodynamic changes usually occurred within 24 hours after LAA occlusion, or within 2-4w for some cases. 3D-TEE can be used to sensitively observe the conditions of occluder displacement, pericardial tamponade, formation of thrombus and bleeding by finding the shunt residual through the images of the spaces between LAA and occluder, which in turn reduced the prevalence of complications. Results of this study showed that overall prevalence of postoperative complications in observation group and control group were 0.00% and 12.24%, respectively; significant difference was found between those two groups (p<0.05), which supported the conclusions mentioned above.

Conclusions

Both 3D-TEE and 2D-TEE were accurate in measuring LAA during LAA occlusion surgery, which in turn increased the success rate of surgery. Compared with 2D-TEE, application of 3D-TEE in treatment of nonvalvular atrial fibrillation with left atrial appendage occlusion is more conducive to th[illegible] se[illegible] the reservoir and can reduce the prevalence of postoperative complications.

Acknowledgements

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Conflict of Interest

The authors have no conflict of interest.

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