Journal of Clinical and Nursing Research, 2023, Volume 7, Issue 5
http://ojs.bbwpublisher.com/index.php/JCNR
Online ISSN: 2208-3693
Print ISSN: 2208-3685

Analysis of the Diagnostic Value of Echocardiography in Patients with Chronic Heart Failure

Weiqian Shi*

Department of Ultrasound, Linyi Zhengzhi Hospital, Linyi 276000, Shandong Province, China

***Corresponding author:** Weiqian Shi, 13355027559@163.com

Abstract: *Objective:* This study aims to analyze the diagnostic value of echocardiography in patients with chronic heart failure. *Methods:* 30 patients with chronic heart failure admitted to our hospital during January 2021 to January 2023 were selected as the observation group, and 30 healthy people who received physical examination in our hospital during the same period were selected as the reference group. Both groups received echocardiography, and the results of the ultrasound examination were compared, and the subjects in the observation group were grouped according to the New York Heart Association (NYHA) cardiac function grading standard. The results of echocardiography in patients with chronic heart failure of different cardiac function grades were compared. *Results:* The left ventricular ejection fraction (LVEF) and ratio of maximum blood flow in the early diastole (E) to movement speed (A) (E/A) in the observation group were lower than those in the reference group, while the left ventricular posterior wall thickness (LVPWd), left ventricular end-diastolic diameter (LVEDD), left ventricular end-systolic diameter (LVESD), left atrial diameter (LAD), and interventricular septal thickness (IVS) were higher than those of the reference group ($P < 0.05$). With the continuous increase of cardiac function grades, the levels of LVEF and E/A in patients with chronic heart failure continued to decrease, while the levels of LVPWd, LVEDD, LVESD, LAD, and IVS continued to increase, and there were significant differences among the groups ($P < 0.05$). *Conclusion:* The application of echocardiography in the clinical diagnosis of chronic heart failure can accurately evaluate the changes of cardiac shape and cardiac function, and provide a reliable basis for clinical diagnosis with a high application value.

Keywords: Chronic heart failure; Echocardiography; Cardiac function

Online publication: September 22, 2023

1. Introduction

Chronic heart failure (CHF) is a comprehensive manifestation of the development of various heart diseases to the end stage. In CHF, the structure and function of the patient's heart have changed, and the pumping and filling functions of the ventricle continue to decline, which in turn leads to the patient's heart failure. Dyspnea and fluid retention pose a great threat to the patient's life [1]. At present, the gold standard for detecting left

ventricular diastolic function is cardiac catheterization, but this method is an invasive operation, thus its application is limited to a certain extent [2,3]. In addition, serum markers are also a commonly used diagnostic method in clinical practice. Although this diagnostic method can also evaluate the severity of the patient's condition and cardiac function to a certain extent, the disadvantage is that it has poor specificity, and it is inaccurate for long-term prognosis prediction. With the continuous advancement of imaging technology, it has played an increasingly important role in the diagnosis of various diseases. Echocardiography can evaluate the degree of damage to patients' heart structure, but it cannot accurately evaluate the degree of damage to heart function. Echocardiography can evaluate not only the structure of the heart, but also the function of the heart, and the procedure is simple, convenient, non-invasive, and low in price, with good repeatability in a short period of time, thus it is generally recognized and favored by medical staff and patients [4,5]. In this study, 30 patients with chronic heart failure admitted to our hospital and 30 healthy people who visited our hospital from January 2021 to January 2023 were selected as the research objects. The purpose of this study is to further analyze the effect of echocardiography in the clinical diagnosis of chronic heart failure.

2. Materials and methods

2.1. General information

A total of 60 subjects were included in the study, of which 30 were patients with chronic heart failure admitted to our hospital from January 2021 to January 2023, named as the observation group, and the other 30 were healthy people who received health examination in our hospital during the same period, named as the reference group. In the reference group, there were 13 females and 17 males, aged 40–71 years, with an average of 55.64 ± 7.46 years old, body mass index (BMI) of 18–27 kg/m^2, with an average of 22.56 ± 2.15 kg/m^2. In the observation group, there were 14 females and 16 males, aged 40–73 years, with an average of 56.19 ± 7.51 years old, BMI of 19–28 kg/m^2, with an average of 22.69 ± 2.21 kg/m^2. Among them, the primary disease of 13 patients was coronary heart disease, 9 patients had dilated cardiomyopathy, 5 patients had hypertensive heart disease, and 3 patients had heart valve disease. The general information of the two groups of research objects was comparable ($P > 0.05$). This study was approved by the ethics committee.

Inclusion criteria:

(1) The research subjects in the observation group met the diagnostic criteria for chronic heart failure [6].
(2) The research subjects in the two groups voluntarily cooperated to complete the relevant inspection items and signed the consent form.
(3) There was no communication or cognitive impairment.

Exclusion criteria:

(1) Patients with congenital heart disease, pericardial effusion, and myocardial infarction.
(2) Patients with severe diseases of important organs such as brain, liver, and kidney.
(3) Patients with cancer.

2.2. Methods

The subjects of both groups received echocardiography. The equipment used was GE cardiac color Doppler ultrasonic diagnostic instrument, model LOGIQ E9. The probe frequency was 3.0–3.2MHz, and phased array probe was selected. The research subjects were instructed to lie on the examination table in the supine position (the left side position is also acceptable), the ultrasound probe was placed at the apex of the suprasternal fossa of the research subjects, and the parasternal and left ventricular long-axis sections of the aortic arch were scanned in sequence. The shape, structure, and function of the heart were carefully observed, and the left

ventricular ejection fraction (LVEF) was calculated, by measuring it through the double-chamber view and the apical four-chamber view, and the maximum blood flow in the early diastole (E) and movement speed (A) were obtained to calculate its ratio E/A. In order to ensure the accuracy of diagnosis, this study was performed by radiologists with rich experience in cardiac ultrasonography, who also observed the images.

2.3. Observation indicators

The echocardiographic examination results between the two groups of research subjects were compared. Comparison indicators included left ventricular posterior wall thickness (LVPWd), left ventricular end-diastolic diameter (LVEDD), left ventricular end-systolic diameter (LVESD), left atrial diameter (LAD), interventricular septal thickness (IVS), left ventricular ejection fraction (LVEF), and E/A. Moreover, the results of echocardiography were compared among the research subjects in the observation group with different levels of cardiac function. Cardiac function grading evaluation was based on New York Heart Association (NYHA) cardiac function grading, the comparison indicators are the same as above.

2.4. Statistical methods

The research data was processed with SPSS24.0 statistical software package, and the measurement data was described by mean ± standard deviation (SD). When the data distribution was normal, an independent sample *t* test was adopted, and the data comparison between multiple groups was performed by the *F* test. $P < 0.05$ indicated that the difference was statistically significant.

3. Results

3.1. Comparison of echocardiographic results between the two groups of research subjects

Compared with the subjects in the reference group, the LVEF and E/A of the subjects in the observation group were lower, and the other indicators were higher ($P < 0.05$), as shown in **Table 1**.

Table 1. Comparison of echocardiographic results between the two groups of research subjects (mean ± SD)

Group	LVPWd (mm)	LVEDD (mm)	LVESD (mm)	LAD (mm)	IVS (mm)	LVEF (%)	E/A
Reference group (n = 30)	8.87 ± 0.22	46.21 ± 2.85	31.17 ± 2.06	30.04 ± 1.18	9.42 ± 0.35	62.52 ± 5.73	1.15 ± 0.16
Observation group (n = 30)	10.14 ± 0.47	58.42 ± 3.54	46.33 ± 3.18	38.19 ± 3.31	13.29 ± 0.37	50.41 ± 5.38	0.71 ± 0.11
t	18.956	20.810	30.992	17.964	58.857	11.934	17.553
P	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001

3.2. Comparison of echocardiographic results of subjects with different levels of cardiac function in the observation group

According to the NYHA classification, among the 30 subjects in the observation group, 8 cases were evaluated as grade I, 10 cases were evaluated as grade II, 8 cases were evaluated as grade III, and 4 cases were evaluated as grade IV. According to the analysis of scientific software, with the increase of cardiac function classification, the LVEF and E/A levels of patients with chronic heart failure continued to decline, while other indicators continued to rise ($P < 0.05$), as shown in **Table 2**.

Table 2. Comparison of echocardiographic examination results of subjects with different levels of cardiac function in the observation group (mean ± SD)

Cardiac function class	No	LVPWd (mm)	LVEDD (mm)	LVESD (mm)	LAD (mm)	IVS (mm)	LVEF (%)	E/A
Class I	8	8.89 ± 0.14	47.18 ± 3.33	34.23 ± 3.45	31.22 ± 1.24	10.16 ± 0.15	61.20 ± 4.74	1.11 ± 0.15
Class II	10	9.72 ± 0.21 *	51.65 ± 4.19 *	38.82 ± 3.61 *	33.72 ± 1.31 *	11.78 ± 0.21 *	56.85 ± 3.45 *	0.96 ± 0.12 *
Grade III	8	10.41 ± 0.29 *#	56.68 ± 3.26 *#	45.37 ± 3.35 *#	37.49 ± 1.55 *#	12.40 ± 0.21 *#	52.23 ± 3.69 *#	0.82 ± 0.13 *#
Grade IV	4	11.18 ± 0.31 *#@	61.57 ± 3.54 *#@	50.26 ± 3.16 *#@	42.38±1.25 *#@	14.37±0.22 *#@	47.14±3.11 *#@	0.60±0.11 *#@
F		204.464	11.589	31.424	224.767	387.670	36.016	35.849
P		< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001

*$P < 0.05$ compared with grade I, #$P < 0.05$ compared with grade II, @$P < 0.05$ compared with grade III

4. Discussion

Chronic heart failure is a common and complicated clinical disease, the treatment is expensive, and it can pose a serious threat to the life of patients [7,8]. Myocardial hypertrophy is the pathological compensation of chronic heart failure. According to the systolic function of the patient's left ventricle, this disease can be subdivided into two categories including systolic chronic heart failure and diastolic chronic heart failure. The left ventricular volume of the patients with systolic chronic heart failure will continue to increase and the contractility of the myocardium is reduced, and the cardiomyocytes of the patients with diastolic chronic heart failure show a tendency of hypertrophy and the filling of the heart is insufficient [9,10]. The pathogenesis of this disease is relatively complicated, and premature heart failure has no specific symptoms. When clinically treating patients with this disease, it is necessary to improve various clinical discomfort symptoms, as well as to treat the primary disease of the patient, so as to prevent myocardial remodeling and improve the patient's cardiac function. Therefore, for patients with chronic heart failure, it is essential to make an early diagnosis and accurately evaluate the progress of the disease.

Cardiac ultrasonography is currently an important method for clinical diagnosis of cardiovascular disease. According to the ultrasound findings, the patient's cardiac cavity structure, blood flow, and heart beat can be evaluated, and clinical physicians can also conduct detailed observations for patients with heart valve disease through this method. In this study, the LVEF and E/A levels of the subjects in the observation group were lower than those in the reference group, and other indicators were higher than those in the reference group ($P < 0.05$). The LVEF and E/A decreased continuously, and other indicators increased continuously ($P < 0.05$), which was consistent with previous research results [11]. This shows that, compared with healthy people, the heart shape of patients with chronic heart failure has changed, and the left ventricular function and blood flow velocity have decreased. When the LAD exceeds the normal range, it indicates that the patient has decreased cardiac function, accompanied by arrhythmia, this is an independent risk factor for heart failure [12,13]. The levels of LVPWd and LVEDD can reflect the systolic and diastolic function of the left ventricle. When they exceed the normal range, it indicates that the pressure of the left atrioventricular valve increases, and it will affect the diastolic and systolic function of the ventricle, which will lead to the decline of cardiac output. Patient suffers from hypertension, myocardial ischemia, or hypertrophic cardiomyopathy usually has thicken interventricular septum. When the diastolic and systolic functions of the left ventricle decrease, the compliance of the left ventricle will increase. If it is accompanied by cardiac interstitial fibrosis or cardiomyocyte hypertrophy, it will also affect stroke volume and cardiac filling function, which can lead to concentric hypertrophy and increased LVPWd and IVS [14,15]. There is a close correlation between LVEF and cardiac function, and if LVEF is lower

than 50%, it indicates a decline in cardiac systolic function. The flow of blood in the left ventricle can reflect the diastolic function of the left ventricle. When the systolic, diastolic functions, and filling capacity of the left ventricle decrease, it will lead to a decrease in the pumping function of the heart.

5. Conclusion

In summary, application of echocardiography in the diagnosis of chronic heart failure can accurately evaluate the shape, function, and damage severity of the heart, which has high application value in clinical diagnostic.

Disclosure statement

The author declares no conflict of interest.

References

[1] Zhao Y, Qiao X, 2021, Evaluation Value of Cardiac Color Doppler Ultrasound Combined with NT-proBNP Level in Long-Term Prognosis of Patients with Chronic Heart Failure. Journal of Medical Imaging, 31(1): 47–50.

[2] Zhang X, Sha R, 2020, Echocardiographic Diagnosis of Hypertensive Left Ventricular Hypertrophy with Left Heart Failure. Chinese Medicine and Clinic, 20(11): 1806–1807.

[3] Hu L, Tang C, Hao L, *et al.*, 2020, Study on the Value of Serum cTnI level Combined with Pulmonary Artery CT Imaging and Echocardiography in Evaluating the Prognosis of Elderly Patients with Heart Failure. Hebei Medicine, 42(1): 24–27, 32.

[4] Gong L, 2020, Analysis of Clinical Diagnostic Value of Cardiac Color Doppler Ultrasound in Chronic Heart Failure with Multiple Etiologies. Imaging Research and Medical Application, 4(9): 215–216.

[5] Nong J, Xu J, Nong H, *et al.*, 2023, Research on the Evaluation Value of Echocardiography for Abnormal Left Ventricular Diastolic Function in Heart Failure. Imaging Research and Medical Application, 7(6): 72–74.

[6] Cardiovascular Branch of Chinese Medical Association, 2014, Guidelines for Diagnosis and Treatment of Heart Failure in China 2014. Chinese Journal of Cardiovascular Diseases, 42(2): 3–10.

[7] Niu W, Li J, Qu C, 2022, Correlation Analysis of ECG, Cardiac Ultrasound and Cardiac Function in Emergency Heart Failure Patients. Chinese Journal of Evidence-Based Cardiovascular Medicine, 14(7): 851–853 + 857.

[8] Zhang C, 2022, Application of Echocardiography in the Diagnosis of Hypertensive Left Ventricular Hypertrophy with Left Heart Failure and Analysis of its Impact on Systolic and Diastolic Blood Pressure Levels. Life Science Instruments, 20(1): 265.

[9] Mao Y, Yang L, Liu B, *et al.*, 2019, Clinical Value of Echocardiography in Evaluating Cardiac Function in Patients with Hypertensive Left Ventricular Hypertrophy and Left Heart Failure and its Relationship with NYHA Classification. Modern Biomedicine Progress, 2019(23): 4474–4478.

[10] Huang B, Liu D, 2023, Evaluation Value Analysis of Color Doppler Ultrasound in Patients with Chronic Heart Failure. Clinical Medical Engineering, 30(5): 595–596.

[11] Guan X, Tang H, Wang C, 2023, Application Analysis of Echocardiography in the Diagnosis of Patients with Chronic Heart Failure. World Compound Medicine, 9(1): 148–151.

[12] Li H, Du X, Zhang B, 2020, Clinical Value of Heart Failure Ultrasound Index in Evaluating Cardiac Function in Patients with Chronic Heart Failure. Journal of Medical Imaging, 30(9): 1607–1610.

[13] Yang Y, 2022, Evaluation Value of Cardiac Color Ultrasound Combined with Serum Albumin on the Prognosis of Patients with Coronary Heart Disease Complicated with Chronic Heart Failure. China Health Engineering, 21(5):

822–824.

[14] Yan Q, Wang J, Wu X, *et al.*, 2020, Evaluation Value of Cardiac Color Doppler Ultrasound Combined with Serum Albumin in the Prognosis of Patients with Chronic Heart Failure. Journal of Medical Imaging, 30(8): 1512–1515.

[15] Song F, 2022, Effect Analysis of Echocardiographic Diagnosis in Patients with Chronic Heart Failure. China Urban and Rural Enterprise Health, 37(3): 146–147.