Role of Echocardiography in Takotsubo Cardiomyopathy

Ming-Jui Hung
Section of Cardiology, Department of Medicine, Chang Gung Memorial Hospital, Keelung, Chang Gung University College of Medicine, Keelung City, TAIWAN.

Corresponding author:
Ming-Jui Hung
Section of Cardiology, Department of Medicine
Chang Gung Memorial Hospital, Keelung
222 Maijin Road, Keelung City 20401, TAIWAN
E-mail: miran888@ms61.hinet.net

Highlights
Takotsubo cardiomyopathy is a reversible left ventricular dysfunction and characterized by reversible electrocardiographic ST-T segment changes. Cardiac imaging is the key to make an initial impression of takotsubo cardiomyopathy and follow-up images confirms the diagnosis of takotsubo cardiomyopathy. Because of the availability and feasibility in acute medical care, echocardiography plays an important role in the assessment of patients with takotsubo cardiomyopathy. With advances in the area of myocardial deformation imaging technique, two-dimensional speckle-tracking echocardiography allows the assessment of multidirectional and layer-specific quantification of left ventricular deformation. Left ventricular ejection fraction more precisely measures geometric changes of the ventricle rather than the contractile function of the myocardium. Therefore, it is suggested that standard echocardiography combined with two-dimensional speckle-tracking echocardiography should be used to evaluate cardiac muscular function especially in takotsubo cardiomyopathy because the diagnosis requires serial evaluation.

Keywords: Cardiomyopathy, echocardiography, takotsubo.

Citation:

To the editor
Takotsubo cardiomyopathy (TC) was first reported in 1990s in Japan.1 It has become a well-known acute cardiac syndrome worldwide. TC is characterized by transient left ventricular dysfunction and electrocardiographic ST-T segment changes mimicking acute coronary syndrome.2 It is usually triggered by a physical, psychological, or neurological stress and is characterized by 3 distinctive features:

1) the emergence of transient left ventricular dysfunction;
2) the presence of regional wall motion abnormality extending beyond a single coronary territory;
3) the absence of significant obstructive coronary artery disease.

Although the precise mechanism for TC remains elusive, there have been several mechanisms proposed to explain its pathophysiology, including diffuse multivessel coronary vasospasm, coronary microvascular dysfunction, or catecholamine toxicity.2,3 In clinical practice, it is very important to differentiate TC from acute coronary syndromes because the treatment strategies are different.4 Prognosis of TC is generally favorable with substantial morbidity and mortality.2 Cardiac imaging is the key to make an initial impression of TC and follow-up images confirms the diagnosis of TC. Because of the availability and feasibility in acute medical care, echocardiography plays an important role in the assessment of patients with TC. In this article, I discuss the utilities of echocardiographic images in the clinical and prognostic implications in patients with TC.

In the acute TC, transthoracic echocardiography can identify the left ventricular morphology. Standard echocardiography is able to detect the location of wall motion abnormality in different TC types. The typical TC defined as apical ballooning usually involves hypokinetic or akinetic midventricular and apical segments of left ventricle. Other variant forms, such as focal, basal or midventricular type of TC, have also been described. In the International Takotsubo Registry, the most common type of TC was the apical type (81.7%), followed by the midventricular type (14.6%), the basal type (2.2%), and the focal type (1.5%).2 The left ventricular ejection fraction is reduced in acute TC with recovery after resolution of myocardial stunning. The magnitude of left ventricular dysfunction is wide and is not related to the distribution of single coronary artery. In addition, the degree of cardiac troponin-I elevation is small in proportion to the extent of wall motion abnormalities. Some investigators found that the product of peak troponin-I and echocardiographic derived left ventricular ejection fraction ≥250 can differentiate TC from acute ST-elevation myocardial infarction.5 The reduced left ventricular ejection fraction was improved at a short-term (5 ± 1.6 weeks) follow-up study.6 The echocardiographic derived left ventricular ejection fraction

* Corresponding author. E-mail: miran888@ms61.hinet.net

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is not only a diagnostic marker but also a prognostic marker for acute TC. The prevalence of right ventricular involvement in TC is about 14.5%. Right ventricular systolic dysfunction provides evidence in differentiating TC from acute anterior wall myocardial infarction. However, no relation of differences in tricuspid annular plane systolic excision to clinical outcome was observed. Therefore, tricuspid annular plane systolic excursion should not be used as a sole parameter in assessing right ventricular systolic function because this parameter cannot reflect the apex involvement of right ventricle. It is suggested that the right ventricular fractional area change measured by standard echocardiography is better to reflect whole right ventricular systolic function in serial evaluation of TC.

With advances in the area of myocardial deformation imaging technique, 2-dimensions speckle-tracking echocardiography allows the assessment of multidirectional left ventricular deformation, i.e. longitudinal and circumferential shortening, radial thickening, and twisting. Compared with acute anterior myocardial infarction, the middle and apical longitudinal strain is more severely impaired in TC because of associated impaired strains in inferior, posterior, and lateral walls. This difference of extent of left ventricular dysfunction, far beyond the left anterior descending coronary artery territory, can differentiate TC from acute anterior myocardial infarction.7 Given its high sensitivity in detecting myocardial abnormality, speckle-tracking echocardiography can highlight that myocardial impairment extends beyond wall motion abnormalities detected by standard echocardiography.8 The strain abnormalities are reversible in TC but lacking prognostic implications; whereas in acute anterior myocardial infarction, strain impairment provides implications of myocardial viability and left ventricular remodeling.9 Right ventricular involvement is occasionally noticed in TC but the assessment by speckle-tracking echocardiography should be used to evaluate cardiac muscular function especially in TC because the diagnosis requires serial evaluation.

In conclusion, the diagnosis of TC needs serial echocardiographic evaluation. The ejection fraction represents geometric changes of the myocardium. The contraction of muscle fiber in the midwall, which is linearly related to circumferential strain,10 better reflects intrinsic contractility than contraction of fibers in the endocardium. Therefore, It can provide more information about left ventricle myocardial deformation in patients with TC using layer-specific quantification of myocardial deformation as assessed by 2-dimensional speckle-tracking echocardiography.

In conclusion, the diagnosis of TC needs serial echocardiographic evaluation. The ejection fraction represents geometric changes of the myocardium. Therefore, it is suggested that standard echocardiography combined with 2-dimensional speckle-tracking echocardiography should be used to evaluate cardiac muscular function especially in TC because the diagnosis requires serial evaluation.

Declarations of interest
The author declares no conflicts of interest.

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