# Complete reverse remodeling in acute stress cardiomyopathy. Is preserved tissue contractility under stress related to reverse remodeling

*Fatih Yalçın, Hülya Yalçın, Nagehan Küçükler, Theodore P. Abraham*

Department of Medicine, Johns Hopkins Medical Institutions; Baltimore, MD-*USA*

## Abstract

Acute stress cardiomyopathy is the unique disease which represents exaggerated and dysfunctional regions of the same cardiac tissue at the same episode. The impressive clinical course which involves the specific region is the stress-mediated exaggerated function of LV base under acutely developed stress induction. After abolishment of stress induction, dysfunctional part of LV which is the midapical myocardium undergoes a complete tissue functional recovery. The evolution of reverse remodeling in acute stress cardiomyopathy has been described using 2 and 3-dimensional echocardiography in the literature. This is the second report regarding reverse LV remodeling in acute stress cardiomyopathy in which we rather evaluate the underlying mechanisms leading complete reverse LV remodeling of dysfunctional myocardium. Therefore, we focus on the existence of preserved and exaggerated regional tissue under stress which possibly represents the predicted myocardial tissue recovery in this acute clinical entity. We also discuss the potential contribution of short-term disease course and lack of prior disease episodes to complete reverse remodeling differently from the heavy burden of chronic diseases leading to permanent tissue jeopardy. *(Anadolu Kardiyol Derg 2014; 14: 73-5)*
**Key words:** acute stress cardiomyopathy, complete reverse remodeling, regional preserved contractility, short-term disease course

## Introduction

Reverse remodeling is a beneficial process with the restoration of elliptical left ventricular (LV) shape after variety of clinic conditions (1). These beneficial course eliminates the pressure and volume overloads with complex mechanisms which preserve the cardiac myocyte size and function. Recently, underlying mechanisms of reverse remodeling which occurs in the subsets of patients whose hearts have undergone reverse remodeling either spontaneously or after medical or device therapies and whose clinical course is associated with freedom from future heart failure events have been evaluated (2). In the article, this process has been clearly pointed out in variety of clinical settings including viral myocarditis and postpartum cardiomyopathy or after removal of a cytotoxic agent.

The evolution of complete reverse LV remodeling has been described using 2- and 3-dimensional echocardiography in the acute stress cardiomyopathy (ASC), (3). This acutely developed syndrome is an interesting clinical presentation for complete LV reverse remodeling in which dysfunctional LV myocardium is completely resolved after normalization of stress stimulus (4, 5) and represents the extraordinary regional myocardial geometric and functional features (6, 7). Mann et al. (2) have mentioned the importance of stress that if during the application of stress the mechanical properties of the material are changed irreversibly, such that the object will return only part way to its original shape when the stress is removed, this is referred to as plastic deformation. It is also mentioned in this article that recovery does not occur in patients with irreversible damage from myocardial ischemia/infarction since plastic deformation exists in the tissue.

Firstly, in the complete reverse remodeling course of ASC, despite positive necrotic parameters including release of cardiac enzymes and ST segment elevation and midapical dysfunc-

**Address for Correspondence:** Dr. Fatih Yalçın, Johns Hopkins University, Department of Medicine 720 Rutland Avenue/Ross Research Building, Rm. 1044 Baltimore, MD 21205-*USA* Phone: 410 502 2505 Fax: 410 955 1509 E-mail: fyalcin1@jhmi.edu
**Accepted Date:** 23.07.2013 **Available Online Date:** 09.12.2013

doi:10.5152/akd.2013.4851

tion, LV geometry completely returns to normal shape after removal of stress (5). Secondly, this is the unique syndrome in which the same cardiac tissue is associated with absolute opponent response of the different LV regions to stress. While midapical part becomes dysfunctional, LV base gives a hypercontractile response under stress which is one of the diagnostic criteria of ASC and may result in intraventricular obstruction (4-7). Regional stress-induced hypercontractility with preserved tissue function can raise the anticipation for reverse remodeling. Nuclear imaging using positron emission tomography revealed the consistent finding that relatively preserved tissue metabolism on LV base is the case compared to apical part in ASC (8). Therefore, existence of regional preserved contractility under stress is possibly an element for prediction of reverse remodeling of dysfunctional part of the same cardiac tissue.

The considerable part of patients with ASC is associated with hypertension (9) and both clinical entities have LV geometric and functional similarities such as prominent and hypercontractile LV base (10). LV basal cavity volume is diminished due to prominent LV basal myocardium in real-time 3-dimensional imaging and hypercontractile LV base under stress is the usual finding in hypertension (11, 12). Stress-mediated exaggerated hypertension, myocardial hypercontractility and LV outflow gradients or increased intracardiac may be detected in hypertensive patients (13-16).

Because of impressive similarities between these entities, it has been reported some controversial cases with hypertensive heart disease (17). Recently, we have published a report to point out some important geometric and functional aspects of hypertensive heart disease to differentiate from ASC for exact diagnosis of controversial cases (18). Tissue Doppler Imaging (TDI) permits a quantitative assessment of both global and regional function (19) and we and others used TDI for quantitative myocardial contractility analysis combined with stress in hypertension (14, 20). We suggested that quantitative tissue analysis under stress in patients who are on effective treatment may contribute to better follow-up and may be beneficial for hypertrophy regression with reverse remodeling in hypertensive heart disease (21).

Complete reverse remodeling in all ASC cases are possibly related to the existence of preserved tissue response even to be regional under stress which could be one of the key elements, since the relation of ASC to stress-related evidences was clearly documented (5). Recent increased attention of the research scientists to evaluation of LV myocardium under stress in chronic patients who are candidate for LV reverse remodeling may produce a widened number of dysfunctional LV myocardial cases which undergo precise evaluation with stress induction. Since LV reverse remodeling covers a wide range of acute and chronic diseases, duration of the clinical entity could be another important factor in addition to existence of regional preserved and exaggerated myocardial function. In chronic cases with dysfunctional LV myocardium in coronary artery disease patients with previous acute episodes, response to therapy for providing reverse remodeling may be relatively lower and compensatory hypertrophic region could exist, but it develops gradually during disease pathogenesis.

On the other hand, hypercontractile LV base is impressively develops in a short duration of the disease course which is not likely to involve interstitial tissue and myocardial plastic property in ASC. In fact, this group of patients are women and have relatively less history of chronic disease burden. In patients with dysfunctional LV myocardium, plastic deformation has been pointed out, which can be validated experimentally and clinically and permits certain predictions with respect to identifying responders and non-responders to medical and device therapies (2). In chronic disease setting, diagnostic application of stress induction can be used for risk stratification and contractile parameters may be blunted under stress (20, 22). It has been documented that medical and device therapies may not be effective in some chronic patients. Furthermore, determination of blunted myocardial response to stress may be important and lack of preserved tissue contractility under stress may be related to lower prediction of reverse remodeling and may identify non-responders to medical and device therapies (23, 24).

## Conclusion

Acute stress cardiomyopathy is associated with a unique process in which both exaggerated and abolished contractility in different regions simultaneously occur. Therefore, the importance of stress-induced regional exaggerated response that develops rapidly in short period of time differently from chronic diseases possibly supports the predicted tissue recovery of dysfunctional myocardium. In ASC, LV geometric and functional features which is associated with the conjunctive points of determination with chronic diseases such as hypertensive heart disease recently has raised the importance of quantitative tissue analysis by TDI. Furthermore, short-term clinical course and lack of the prior episodes of disease with permanent myocardial jeopardy in this syndrome may be other significant elements for prediction of the complete reverse remodeling.

**Conflict of interest:** None declared.

**Grants and Support:** FY and HY are supported by the U.S. Government Fulbright Scholarship, Washington DC, USA.

**Authorship contributions:** Concept - F.Y., H.Y., N.K.; Design - F.Y., H.Y., N.K.; Supervision - F.Y., H.Y., N.K., T.P.A.; Analysis &/or interpretation - F.Y., H.Y., N.K., T.P.A.; Literature search - F.Y., H.Y., N.K., T.P.A.; Writing - F.Y., H.Y., N.K., T.P.A.; Critical review - F.Y., H.Y., N.K., T.P.A.; Other - F.Y., H.Y., N.K., T.P.A.

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