



## Diastolic dysfunction and the Risk of Heart Failure: Therapeutics Approaches

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### Abstract

Diastolic dysfunction is the alteration or the decline in the activity of of the ventricular function. It affects affects the organ's capacity to fill with an adequate amount of blood during diastole. These alterations involve active or passive relaxation. Acute hypertension, ischemia, Infarction, Aortic Stenosis, Idiopathic Hypertrophic Cardiomyopathy, Diabetes and Obesity are the common causes of diastolic dysfunction. Alterations in the myocardial diastolic properties lead to left ventricular diastolic dysfunction which finally leads to diastolic heart failure. In this review, several therapeutic approaches including pharmacologic, nonpharmacologic, and surgical approaches for the treatment of diastolic dysfunction and heart failure will be discussed.

**Keywords:** Diastolic dysfunction; Heart failure; Left ventricular stiffness

### Introduction

Heart failure (HF) is a clinical syndrome which occurs when the pumping power is weaker than the normal power which results in slower flow rate through the heart and body. As a result heart cannot pump blood sufficiently to meet the needs of the body parts [1-4].

Heart pumping action occurs in two ways, one is diastole and the other is systole. In diastole blood gets collected in the lower heart chambers and then it pushed through valves. Once the ventricles are filled with blood, the second part of the pumping action begins [5-9]. The ventricles contract and blood is pushed from the right ventricle into the pulmonary artery and from the left ventricle into the aortic valves. This part is called systole [10].

When the diastole part of the pumping action is abnormal, then it refers to the Diastolic dysfunction. In this type of disorder, the ventricles becomes stiff and do not relax properly as a result, they cannot fill with blood properly. This causes blood to block in other parts of the body [11-14].

The diastolic dysfunction is caused by stiffened ventricles that cannot dilate to accommodate incoming blood properly. Then the blood will be filled inadequately in the ventricles which can lead to a flow of blood back into the atrium and then sometime to lungs. This finally shortens the oxygen blood to the lungs, causing shortness of breath and sometimes even leads to death if not treated immediately [15-20].

Journals which are available without any financial or legal or technical barriers to the readers are Open access journals. These Journals has more visibility and also more accessibility which helps readers, scientists and professional worldwide to gain the

knowledge and information [21-25]. Peer reviewed journals publish the high quality articles after it has been subjected to multiple reviews by scholars or scientists who are experts in that particular field [26].

The societies are primarily meant for enhancement of science and technology, which are mainly educational and information [27-32]. Their role is to develop to professional excellence, bring awareness among the people, to publish professional journals, to raise public awareness, and to make awards. Through their work, they help to set standards for their professional fields and to promote high standards of quality through awards and other forms of recognition [33-39].

Treatment should target the underlying pathological condition that causes the diastolic heart failure. The treatment depends upon the type of the disease [40]. The pharmacological agent upon intake that makes myocardial relaxation and improves LV compliance is the ideal treatment of diastolic dysfunction [41-46]. A number drugs used for the treatment of heart failure and their symptoms due to diastolic dysfunction. The drugs are similar to both systolic and diastolic dysfunction, although the dosage of the drug may alter the action [47-52].

European Society of Cardiology is another Society which mainly organizes many scientific meetings and programs which is mainly aimed for professionals of cardiology which brings awareness for the treatment and care of Heart disease. The society National Heart Forum of UK is an organization in the UK which mainly working to bring awareness among the people about the heart diseases and to reduce the risk of non-communicable diseases [53-59]. It also promotes the educational activities related to the development of knowledge regarding cardiovascular health and practice, which is mainly related to treatment and prevention of cardiovascular disease. Another society- Mongolian society for Pediatric cardiology which focuses on major topics Myocardial Infraction, Heart failure, Congenital Heart Disease, Cardiomyopathy, and Rheumatic Heart Disease [60-65].

Cardiovascular Pharmacology Journal is an open access Journal, in this journal, therapeutical approaches for cardiovascular, Cardiovascular Safety, Cardiovascular Drugs, Cardio Pharmacology, Cardiac Arrest are discussed. Journal of Clinical & Experimental Cardiology is an open access Journal which explores the topics related to Heart Diseases, Cause of Heart Failure, Cardiac Surgery, Sudden Cardiac arrest, Heart Transplants [66-71]. International Journal of Cardiovascular Research is a hybrid open access which explores the topics on Heart Failure, Cardiomyopathy, Cardiac Transplantation, Heart Diseases [62-67]. The 2nd International Conference on Cardiovascular Medicine and Cardiac Surgery which is going to be held on March 15-16, 2017 in London, UK explores the possibilities towards better Cardiac Health [72-77].

### **Diastolic dysfunction causes**

The abnormal stiffening of the ventricular wall and inadequate filling of ventricles is referred to as diastolic dysfunction and when this leads to a build-up of blood in other organs such as the lungs, diastolic heart failure is diagnosed [78]. The article entitled “The Association between Arterial Stiffness and Post-cardiac Surgery Renal and Diastolic Heart Functions” studied on left ventricular (LV) diastolic functions.

Factors that increase the risk of the ventricular walls becoming stiff are therefore considered risk factors for diastolic dysfunction [79,80].

A conference abstract entitled “Diastolic dysfunction and heart failure: Mechanism and experimental treatment” focused on patients who suffer from a diastolic dysfunction with a normal or near normal cardiac contraction.

### **Factors that can lead to ventricular hardening:**

**Hypertension:** High blood pressure which causes the heart to pump harder to push the blood through the blood vessels and thereby causes the thickening of the muscles of the left ventricle, which results in ventricular hypertrophy which eventually turns into left ventricular stiffness [81-84].

**Aortic stenosis:** In this disease, the opening of the heart's aortic valve gets narrowed. This makes the heart to work more harder to distribute blood to all the parts of the body, which finally leads to hypertrophy of the muscle which eventually causes stiffness in the left ventricle [85-89].

**Heart attack:** A scar tissue often forms in areas of the muscles that were starved of oxygen after a heart attack. This scar tissue is less elastic and is stiff, than the original muscle tissue, which causes stiffness of the ventricle which finally give rise to ventricular dysfunction [90-94].

**Diabetes:** In long standing diabetic patients, high blood sugar causes glycosylation of the heart muscles due to which leads to stiffening of the muscles and eventually to diastolic dysfunction [95-99].

**Systolic heart failure:** In systolic heart failure, the ventricle walls become non elastic due dilation which occurs due to more accommodation of the blood, which finally leads to diastolic dysfunction.

The article with title "Assessment of Left Atrial Ejection Force in Patients with different Grades of Left Ventricular Diastolic Dysfunction" discussed completely on Ventricular dysfunction [100-105].

### **Therapeutic Strategies for Diastolic Dysfunction: A Clinical Perspective**

An article entitled "The Prevalence of Left Ventricular Hypertrophy and Altered Geometry in Patients with Right Ventricular Diastolic Dysfunction" evaluated an association between Right ventricular diastolic dysfunction, Left ventricular diastolic dysfunction, Left ventricular concentric geometry and Left ventricular hypertrophy altered geometry for early diagnosis of heart failure [106-110].

#### **A. Pharmacologic Therapy**

- **Angiotensin converting enzyme (ACE) inhibitors and angiotensin II receptor blockers:**

ACE-inhibitors and angiotensin II receptor blockers show effect on only blood pressure, but elicit a direct effect via the local renin-angiotensin system on the myocardium. These effects are responsible for the regression of LV hypertrophy and thereby improve the elastic properties of the myocardium [111-117].

- **Beta-blockers:**

Beta blockers potentially helps in improving the diastolic filling indirectly by way of negative chronotropic effect and thus helps increase in the time for diastolic filling.[118-122].

- **Ca<sup>2+</sup>-channel blockers**

Calcium channel blockers helps improving diastolic filling in the patients with heart failure and impaired diastolic filling [124].

#### **B. Surgical Treatment**

Surgical treatment is useful in patients suffering with particular disease that leads to cause diastolic dysfunction. As mentioned before, myocardial ischemia results in noticeable changes in the left ventricle, diastolic properties. Coronary artery bypass graft surgery should aid in relieving myocardial ischemia in patients with heart disease [125-131].

### **C. Gene Therapy**

Recent research on genetic and molecular mechanism of diastolic dysfunction has resulted in newer therapeutic applications like gene therapy. Aging of mammalian heart is associated with impairment in cardiac relaxation. Senescent myocytes possess prolonged relaxation characteristics along with reduced contractility and  $\beta$ -adrenergic response [132-137]. This impairment will result in increased chances and incidents of heart failure in the elder people. Recent research studies have proven that targeting SERCA2 will help in improving diastolic functioning in the aging myocardium [138-142].

### **D. Specific therapy**

The first medical approach towards treatment of diastolic dysfunction is therapy using beta blocker, which reduces the heart rate and helps the ventricles time to fill with blood. The importance of specific agents in treating diastolic dysfunction is unknown and some recent studies reveal that calcium channel blockers may help in reducing ventricular stiffness [143-146]. Angiotensin converting enzyme inhibitors (ACEI) are effective in preventing ventricular remodeling and some of the drugs used are lisinopril, enalapril, ramipril, fosinopril, moexipril, perindopril, quinapril, benazepril and captoprilb [147-150].

### **Conclusion**

This review discussed the causes of diastolic dysfunction, but still the study has to be done for the exact cause. The various therapeutical approaches has been discussed in the article, still more inventions have to be continued for best therapy

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