# Isolated Noncompaction of Left Ventricular Myocardium With an Unusual Presentation of Angina Pectoris

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*A 45-year-old man presented to the hospital with typical chest pain compatible with myocardial infarction. An electrocardiogram showed left bundle branch block. The patient underwent urgent coronary angiography, which revealed no significant coronary artery disease. Echocardiography showed noncompaction of the left ventricular myocardium. This unusual case of angina occurring in a patient with isolated noncompaction of the left ventricle is discussed with a review of the literature.*
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A 45-year-old man with a 3-month history of typical angina presented with a prolonged episode of angina lasting more than 30 minutes. An electrocardiogram revealed new onset of left bundle branch block (LBBB). The patient underwent urgent coronary angiography, which showed no significant coronary artery disease (Figure 1). His left ventriculography showed moderate left ventricular (LV) systolic dysfunction (ejection fraction [EF] of 35%) without localized wall motion abnormalities. His cardiac enzymes were negative. He had a history of aborted sudden cardiac death in another hospital a few months earlier. He had refused further work-up at that time.

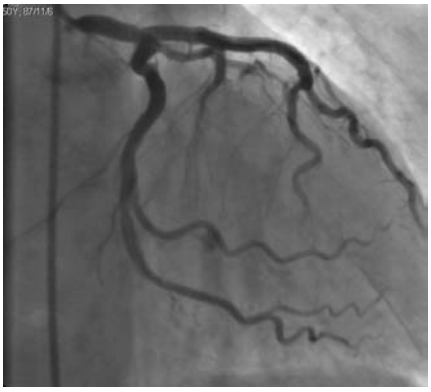

**Figure 1.** *Angiogram shows no significant coronary artery disease.*

The patient's echocardiogram showed a dilated left ventricle with multiple trabeculations communicating with the LV chamber by color Doppler, consistent with the diagnosis of isolated noncompaction of the left ventricular myocardium (INCLV) (Figure 2).

## Discussion

Isolated noncompaction of the left ventricular myocardium is a rare cause of cardiomyopathy. It is characterized by an abnormal myocardial wall with prominent trabeculae and deep intertrabecular recess that is thought to be due to intrauterine arrest of compaction.[1,2] In the developing embryonic heart, there is a collection of loose myocardial fibers that slowly condense into a solid cardiac structure in a process known as *compaction*.[3]

The prevalence of left ventricular noncompaction (LVNC) in the general population is not known, but is estimated to be between 0.05% and 0.24%.[4,5] A recent review found a prevalence of 0.14% using echocardiograms.[6] INCLV can be either sporadic or familial. In 1 report, 6 of 34 patients (18%) had a family history of INCLV.[6] Autosomal dominant inheritance is more common than X-linked or autosomal recessive inheritance.[7] Several genes have been identified such as mutation in the X-dystrobrevin G4.5, FK binding protein-12 (FKBP-12)[8,9] and abnormal locus on chromosome 11p15.[10] In one family, mutation in the genes for another cytoskeletal protein Cypher/ZASP has been found.[11,12] The E 101 K mutation in the α-cardiac actin gene has been identified in families with INCLV, septal defect, and apical hypertrophic cardiomyopathy.[13]

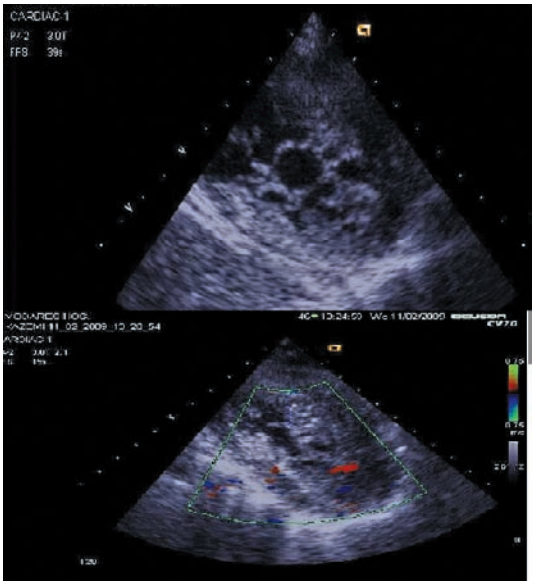

**Figure 2.** *Echocardiogram shows classic appearance of isolated noncompaction of the left ventricle.*

The first reported case of INCLV was identified in a 33-year-old woman presenting with heart failure symptoms and LBBB on electrocardiogram in 1984.[3] Further studies have shown that clinical manifestations of INCLV are highly variable. Some patients may present with decompensated heart failure whereas others have no symptoms with a diagnosis made incidentally during routine school electrocardiographic screening. The clinical course is also highly variable with some patients remaining asymptomatic for their lifetimes, whereas others may rapidly progress to an end-stage heart failure necessitating heart transplantation.

The major clinical manifestation of INCLV is related to systolic dysfunction and heart failure and can cause atrial and ventricular arrhythmias. Thromboembolic events due to intertrabecular thrombus formation have been reported. In 1999, Ichida and colleagues reported the clinical feature of 27 children with INCLV. In this cohort, 88% had electrocardiographic abnormalities such as T-wave changes in the inferior or inferolateral leads (37%), Wolff-Parkinson-White syndrome (WPW) (15%), right bundle branch block (RBBB) (11%), left axis deviation (22%), and less commonly, LBBB, ventricular hypertrophy, or left anterior fascicular block.[5]

INCLV has a different presentation in adults, of which dyspnea is the most common symptom, occurring in 79% of cases. Other signs and symptoms include chest pain in 26%, LBBB in 44%, repolarization abnormalities in 36%, atrial fibrillation in 26%, and RBBB in 12% of cases. WPW has not been reported in adults. In 1 study, INCLV was considered to be the cause of angina pectoris, similar to our case with chronic myocardial ischemia related to an impaired microvascular function as

the cause of progressive myocardial dysfunction.[14]

The most widely accepted imaging method for the diagnosis of INCLV is echocardiography. An established recommendation for the diagnosis of INCLV has been published.[15-17] The presence of greater than 3 prominent trabeculations protruding from the LV wall with deep intertrabecular recesses is an important feature of INCLV. Direct blood flow from the ventricular cavity into the intertrabecular recesses as visualized on color Doppler, absence of any coexisting cardiac abnormalities, and ratio of noncompacted subendocardial layer to compacted subepicardial layer $\geq$ 2 at end systole are other important features of INCLV.

$^{201}$Tl myocardial imaging has been used to determine hypoperfusion in the areas of noncompacted myocardial tissue. CT scan has been effective in demonstrating areas of fibrosis whereas MRI is more useful in highlighting the anatomy between compacting and noncompacted myocardial layers.[18,19] INCLV has also been associated with numerous neuromuscular disorders,[15] although in 39% of cases the type of neuromuscular disorder could not be classified. Thus, neurologic evaluation of these patients is highly recommended. Stroke and thromboembolic events have also been reported in association with INCLV,[4,6] which can be as high as 24%.[6] Prognosis of INCLV is not known and morbidity and mortality are usually related to heart failure, arrhythmia, and thromboembolism; however, many are asymptomatic for unknown duration or lifelong. Mortality rates vary from 35% in one study to 15% in another.[6,20] In many cases, INCLV is a progressive cardiomyopathy that can lead to severe congestive heart failure. Once it is diagnosed, close follow-up is highly recommended to detect and treat progression and complications.[21]

## Management

Due to its rarity, there are no current studies evaluating specific treatments for INCLV. Standard treatment of systolic dysfunction or heart failure is the main stem therapy such as angiotensin-converting enzyme inhibitors and β-blockers. Harada and associates reported significant improvement in the diastolic function and exercise tolerance using carvedilol.[22] Thromboembolic events are common and require anticoagulation therapy[17]; however, routine use of oral anticoagulation for prevention of stroke or systemic embolism remains controversial.[6,23]

Ventricular tachyarrhythmias are a common and deadly complication of INCLV. Holter monitoring should be considered annually to detect silent arrhythmia. Indications for automatic implantable cardioverter defibrillator insertion should be similar to those with other causes of systolic dysfunction. Cardiac resynchronization may improve LV function and prevent ventricular arrhythmia.[3,21] Heart transplantation should be considered in patients with progressive and end-stage heart failure. ■

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## Main Points

- The prevalence of left ventricular noncompaction in the general population is not known but is estimated to be between 0.05% and 0.24%, and can be either sporadic or familial.
- The major clinical manifestation of isolated noncompaction of the left ventricular myocardium (INCLV) is related to systolic dysfunction and heart failure, which can result in atrial and ventricular arrhythmias. In adults, dyspnea is the most common presentation with other signs and symptoms including chest pain, LBBB, repolarization abnormalities, atrial fibrillation, and RBBB.
- Available therapies for INCLV include angiotensin-converting enzyme inhibitors and β-blockers. Carvedilol therapy has shown significant improvement in the diastolic function and exercise tolerance. Thromboembolic events are common and require anticoagulation therapy; however, routine use of oral anticoagulation for prevention of stroke or systemic embolism is controversial.

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