Hepatology Snapshot:

Cirrhotic cardiomyopathy

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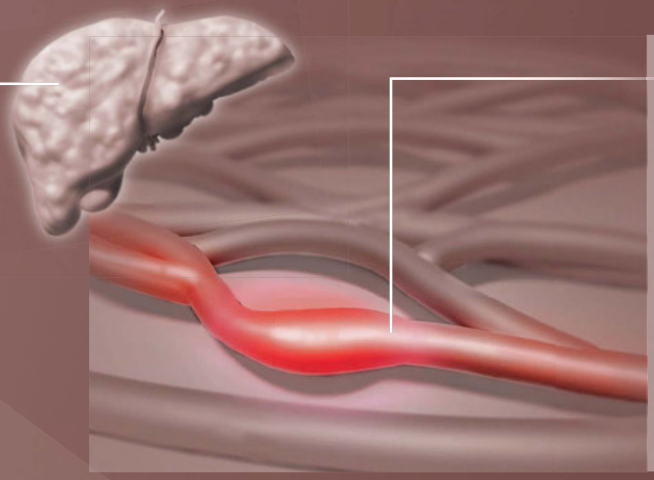
Søren Møller[1], Samuel S. Lee[2]

[1]Department of Clinical Physiology and Nuclear Medicine, Center for Functional and Diagnostic Imaging and Research, Hvidovre Hospital, Faculty of Health Sciences, University of Copenhagen, Denmark; [2]Liver Unit, Cumming School of Medicine, University of Calgary, Calgary, Canada

Cirrhotic cardiomyopathy

An association between liver and cardiac function has been known for many years. In patients with cirrhosis a specific type of cardiac dysfunction occurring independently of the etiology of liver disease has been termed cirrhotic cardiomyopathy. The pathogenic mechanisms underlying cirrhotic cardiomyopathy comprise various factors acting at the molecular and cellular level.



Vasodilatation

Liver dysfunction and portosystemic shunting lead to release of potentially harmful liver-derived vasodilators and cardio-suppressive factors causing arterial vasodilatation.

Hyperdynamic circulation

Vasodilatation leads to hyperdynamic circulation and circulatory dysfunction*, characterized by increased cardiac output and heart rate, and low arterial blood pressure and decreased vascular resistance.

Definitions of cirrhotic cardiomyopathy

Supportive criteria

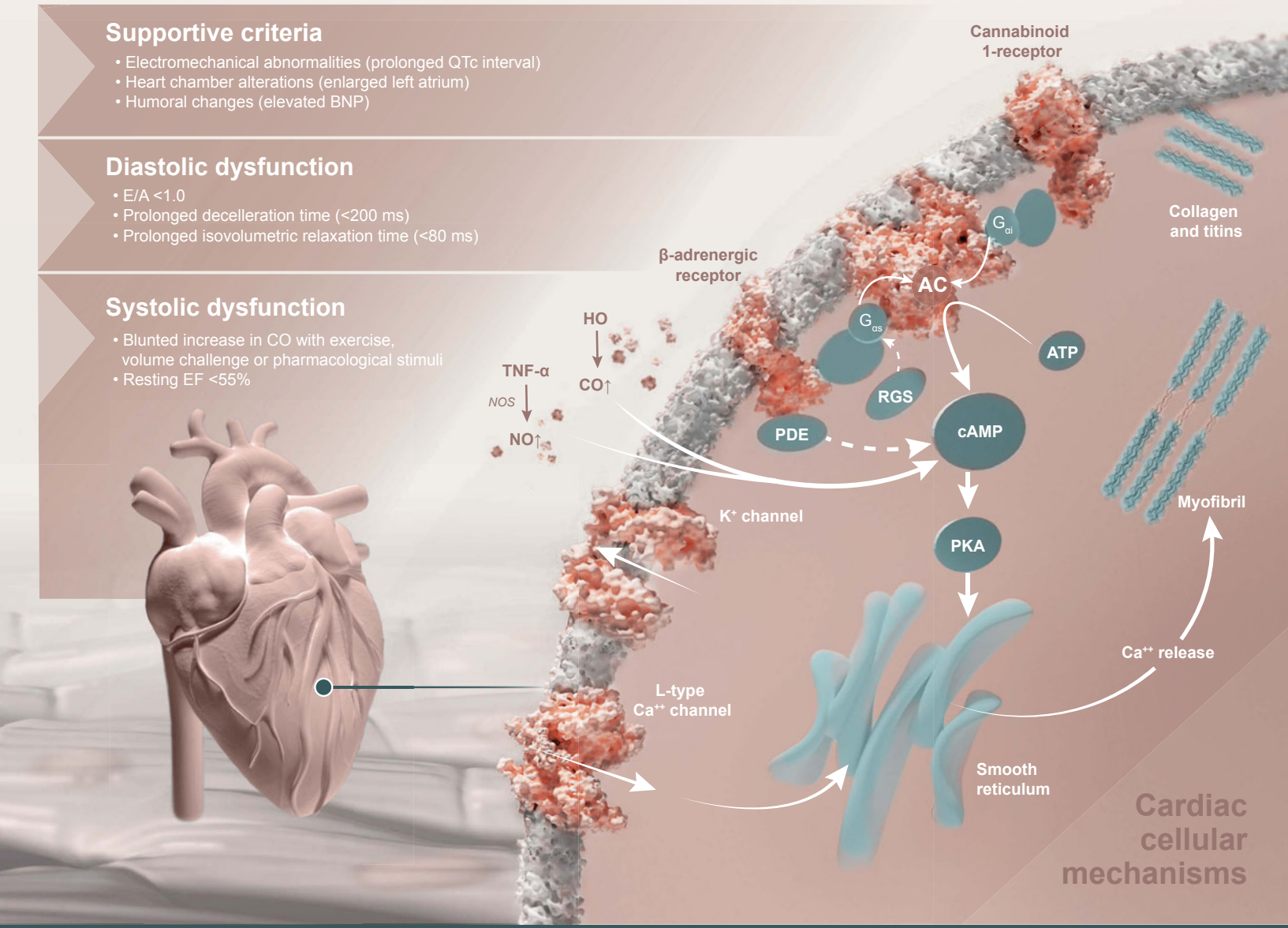
- Electromechanical abnormalities (prolonged QTc interval)
- Heart chamber alterations (enlarged left atrium)
- Humoral changes (elevated BNP)

Diastolic dysfunction

- E/A <1.0
- Prolonged decelleration time (<200 ms)
- Prolonged isovolumetric relaxation time (<80 ms)

Systolic dysfunction

- Blunted increase in CO with exercise, volume challenge or pharmacological stimuli
- Resting EF <55%



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*Evaluated by right-heart catherisation

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An association between liver function and heart function has been known for many years.[1] Patients with alcoholic cirrhosis may develop alcoholic cardiomyopathy, and patients with non-alcoholic steatohepatitis are at increased risk of developing cardiovascular complications.[2] In patients with cirrhosis a specific type of cardiac dysfunction named cirrhotic cardiomyopathy has been coined, and this is independent of the etiology of the liver disease.[1,3]

Cirrhotic cardiomyopathy is part of a diverse array of cardiovascular abnormalities in cirrhosis. Combined liver dysfunction and portosystemic shunting lead to the release of potential liver-derived harmful vasodilators and cardio-suppressive factors from the liver into the circulation leading to an arterial vasodilatation.[2] This may progress to a hyperdynamic circulation characterized by increased cardiac output and heart rate and low arterial blood pressure and decreased systemic vascular resistance.[3] In addition, the patients show abnormal plasma volume distribution characterized by splanchnic pooling and central hypovolemia.[2]

Pathogenic mechanisms underlying cirrhotic cardiomyopathy comprise various factors acting at the molecular and cellular level.[4,5] An underlying proinflammatory state of cirrhosis triggers a diverse cascade of often interrelated mechanisms. In the cardiomyocyte, these include abnormal lipid biochemical and biophysical changes in the plasma membrane and calcium-handling machinery that lead to abnormal membrane receptor function, particularly of the stimulatory beta-adrenergic system. Various negative-inotropic pathways are activated, mostly caused by the inflammatory stimuli, including nitric oxide, carbon monoxide, endocannabinoids and cytokines such as TNF-α. These result in increased cardiomyocyte apoptosis and even a shift in myosin heavy chain isoform from the more powerful α-subtype to the weaker β-isoform.

In 2005 a working definition of cirrhotic cardiomyopathy was launched at a working party held at the World Congress of Gastroenterology in Montreal.[2] Cirrhotic cardiomyopathy is characterized by a combination of systolic dysfunction, impaired diastolic relaxation and electrophysiological disturbances such as prolonged QT_C interval.[3,5] Systolic dysfunction is defined by a blunted increase in cardiac output on exercise or pharmacological stimuli, and a resting ejection fraction <55%. Diastolic dysfunction is defined as a E/A ratio <1.0, a prolonged deceleration time (>200 ms) and prolonged isovolumetric relaxation time (>80 ms).[6,7] In addition, supportive criteria include electrophysiological abnormalities (prolonged QT_C interval), heart chamber alterations (enlarged left atrium and myocardial hypertrophy), and humoral changes (elevated B-type natriuretic peptide, atrial natriuretic peptide and hs-Troponin-1).[5,7,8]

Cirrhotic cardiomyopathy may be revealed during an exercise electrocardiogram, pharmacological stress or by Doppler echocardiography including speckle tracking with measurement of strain.[5,7] Newer modalities include magnetic resonance imaging with determination of flow and extracellular volume.

Cirrhotic cardiomyopathy may be present in up 50% of patients with cirrhosis and seem independently of other complications of cirrhosis such as the portopulmonary syndrome and the hepatopulmonary syndrome.[9] It may be implicated in complications such as development of hepatorenal syndrome as part of a cardio-renal syndrome.[2] Cardiodepression during inflammatory conditions such as bacterial infection may contribute to the pathogenesis of acute kidney injury[10,11] and acute-on-chronic liver failure.[4]

Cirrhotic cardiomyopathy complicates several therapies used in cirrhosis. Although beta blockers may be harmful in decompensated patients with ascites, at the same time these drugs may normalize the prolonged QT_C interval. Similarly, although terlipressin is useful to treat type 1 hepatorenal syndrome, it can further reduce cardiac function in patients with cirrhotic cardiomyopathy.[3] In patients treated by transjugular intrahepatic portosystemic shunt, the prognosis is poorer in the presence of diastolic dysfunction. Cardiac dysfunction should also be considered prior to liver transplantation as overt heart failure may affect the pretransplant course and manifest postoperatively.[5] Therefore, patients with cirrhosis should have a careful cardiovascular evaluation before transplantation.[12] Conversely, liver transplantation has been shown to reverse cardiac dysfunction and improve electrophysiological abnormalities.[13] Treatment of cirrhotic cardiomyopathy is nonspecific and supportive and should seek to minimize risks related to invasive procedures and treatments.[2,5,7]

Conflict of interest

The authors declare no conflicts of interest that pertain to this work.

Please refer to the accompanying ICMJE disclosure forms for further details.

Authors' contributions

Both authors contributed equally to this snapshot.

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