Cirrhotic cardiomyopathy

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Cirrhotic cardiomyopathy (CC)

**Agenda**

- Definition
- Pathogenesis
- Diagnosis
- Clinical aspects
- Treatment
The current working definition of “cirrhotic cardiomyopathy” was proposed in 2005 during the World Congress of Gastroenterology in Montreal (Canada).

It includes: a) diastolic dysfunction, b) systolic dysfunction, and c) electromechanical abnormalities with prolonged QT interval in patients with cirrhosis in the absence of other known causes of cardiac disease.

*S. Møller et al. Gut 2008; 57: 268–278*
## Cirrhotic cardiomyopathy (CC)

### Macroscopic anatomical cardiac abnormalities

<table>
<thead>
<tr>
<th>Autopsy findings</th>
<th>With ascites (n° =53)</th>
<th>Without ascites (n° =80)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender (Male/Female)</td>
<td>28/25</td>
<td>40/40</td>
<td>N.S.</td>
</tr>
<tr>
<td>Age (years±SD)</td>
<td>Not reported</td>
<td>Not reported</td>
<td>N.S.</td>
</tr>
<tr>
<td>Normal heart</td>
<td>20 (38%)</td>
<td>56 (70%)</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>Macroscopic anatomical cardiac abnormalities</td>
<td>33 (62%)</td>
<td>24 (30%)</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>- Cardiomegaly</td>
<td>23 (43%)</td>
<td>24 (30%)</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>- Left ventricular hypertrophy</td>
<td>11 (21%)</td>
<td>12 (15%)</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>- Bi-ventricular hypertrophy</td>
<td>9 (17%)</td>
<td>6 (8%)</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>- Right ventricular hypertrophy</td>
<td>2 (4%)</td>
<td>1 (1%)</td>
<td>N.S.</td>
</tr>
<tr>
<td>- Valvulopathy</td>
<td>5 (9%)</td>
<td>4 (5%)</td>
<td>N.S.</td>
</tr>
<tr>
<td>- Others (pericardial effusion, pericarditis, ischemic)</td>
<td>4 (8%)</td>
<td>4 (5%)</td>
<td>N.S.</td>
</tr>
</tbody>
</table>

Cirrhotic cardiomyopathy (CC)

Microscopic findings in the cardiac tissue of patients with cirrhosis (fibrosis)

The arrows indicate lines of fibrous tissue bridging the gap between transversely ruptured muscle fibers.

Cirrhotic cardiomyopathy (CC)

Microscopic findings in the cardiac tissue of patients with cirrhosis (inflammation)

Cirrhotic cardiomyopathy (CC)

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Cirrhotic cardiomyopathy

Pathological study of the heart and liver of the patients with cardiac hypertrophy showed that in 9 of the 12 patients the accompanying portal cirrhosis was early or only moderately advanced. It is suggested that the cardiac hypertrophy in these cases was due to the increased cardiac output associated with peripheral vasodilatation in the early stages of portal cirrhosis.

Peripheral arterial vasodilation “hypothesis”

Portal hypertension/liver failure

Increased release of NO, CO and other vasodilators

Splanchnic arterial vasodilation

Reduction of effective circulating volume

Activation of endogenous vasoconstrictor systems

Left ventricular hypertrophy

Cirrhotic cardiomyopathy (CC)

Mechanisms by which aldosterone and/or mineralocorticoid receptor (MR) in heart fibrosis
Cirrhotic cardiomyopathy (CC)

Effect of losartan (AT1 receptor antagonist) on the effect of thoracic aortic constriction (TAC) on left ventricular/body weight ratio in mice

Cirrhotic cardiomyopathy (CC)

Effect of losartan on activation of DNA synthesis by angiotensin II (Ang II) in cardiac fibroblasts

Cirrhotic cardiomyopathy (CC)

Effect of antioxidants (NAC, Catalase) on activation of DNA synthesis by angiotensin II (Ang II) in cardiac fibroblasts

Cirrhotic cardiomyopathy (CC)

Left ventricular hypertrophy according to the mean level of plasma renin activity

\[
\begin{align*}
P &< 0.01
\end{align*}
\]

\[\begin{align*}
\text{PRA (9 ng/kg/h)} & & \text{PRA (15 ng/kg/h)} & & \text{PRA (30 ng/kg/h)}
\end{align*}\]

\[\begin{align*}
\% & & \% & & \%
\end{align*}\]

Cirrhotic cardiomyopathy (CC)

Independent predictors for the development of diastolic dysfunction in cirrhosis

<table>
<thead>
<tr>
<th>Variables</th>
<th>RR</th>
<th>95 % CI</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endotoxins (μg/ml)</td>
<td>1.103</td>
<td>1.007-1.209</td>
<td>0.035</td>
</tr>
<tr>
<td>Age (years)</td>
<td>1.081</td>
<td>1.007-1.159</td>
<td>0.031</td>
</tr>
<tr>
<td>Etiology (Alcoholic/non Alcoholic)</td>
<td>0.076</td>
<td>0.011-0.542</td>
<td>0.010</td>
</tr>
</tbody>
</table>

Cirrhotic cardiomyopathy (CC)

Effects of cholestasis and i.p. CCL4 injections on bacterial translocation

Cirrhotic cardiomyopathy (CC)

TNFα mRNA in the cardiac tissue of BDL mice

* = P < 0.05 vs Sham-V  § = P < 0.05 vs BDL-V

Cirrhotic cardiomyopathy (CC)

iNos mRNA levels in the cardiac tissue of BDL mice

Cirrhotic cardiomyopathy (CC)
Cirrhotic cardiomyopathy (CC)

Maximal contraction velocity in BDL mice

* = P < 0.05 vs Sham-V
# = P < 0.05 vs BDL-V

Cirrhotic cardiomyopathy (CC)

Cardiomyocytes isolated from left ventricle

<table>
<thead>
<tr>
<th>Variables</th>
<th>Sham</th>
<th>CBDL</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lenght (μm)</td>
<td>113.0±2.1</td>
<td>119.8±1.5</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Width (μm)</td>
<td>18.8±0.5</td>
<td>21.1±0.5</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Area (μm²)</td>
<td>2,201±150</td>
<td>2,501±100</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>

Cirrhotic cardiomyopathy (CC)

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• Definition
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Cirrhotic cardiomyopathy (CC)

Definitions

- Heart failure (HF) can be defined as the inability of the heart to provide sufficient forward output to meet the perfusion and oxygenation requirements of the tissues while maintaining normal filling pressures. There are two major mechanisms by which this can occur.
- **Diastolic dysfunction**, in which there is abnormal cardiac relaxation, stiffness or filling
- **Systolic dysfunction**, in which there is impaired cardiac contractile function.
Cirrhotic cardiomyopathy (CC)

Measurements of diastolic function (1)
Diagnosis of diastolic dysfunction

Diastolic dysfunction was early defined (Montreal 2005) as an early diastolic/atrial filling ratio (an age corrected E/A < 1)
Cirrhotic cardiomyopathy (CC)

Echocardiography evaluation by means of tissue doppler imaging (TDI) of left ventricular diastolic dysfunction according to the latest guidelines of the American Society of Echocardiography

<table>
<thead>
<tr>
<th>Diastolic Dysfunction</th>
<th>E/e# av*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Either septal velocity &lt;8 or lateral velocity &lt; 10</td>
<td>E/e’av ≤ 8</td>
</tr>
<tr>
<td>Grade 1</td>
<td>E/e’ av 9-12</td>
</tr>
<tr>
<td>Grade 2</td>
<td>E/e’av ≥ 13</td>
</tr>
<tr>
<td>Grade 3</td>
<td></td>
</tr>
</tbody>
</table>

e# = early diastolic mitral annular velocity
av* = (e’ from septal side + e’ from lateral side)/2

Cirrhotic cardiomyopathy (CC)

Diagnosis of systolic dysfunction

\[ \text{LVEF (\%)} = \frac{\text{SV}^*}{\text{LVEDV}} \times 100 \]

*where SV = LVEDV - LVESV

- The three major determinants of the left ventricular stroke volume are the preload (venous return and end-diastolic volume), myocardial contractility (the force generated at any given end-diastolic volume), and the afterload (aortic impedance and wall stress).
- Because myocardial contractility is an important determinant of LVEF, LVEF and contractility are frequently considered to be interchangeable. But they are not the same: thus it is possible to have a normal Ef despite a reduced contractility when there is a reduction of the afterload.
Cirrhotic cardiomyopathy (CC)

Left ventricular ejection fraction before and after the intravenous administration of 2 mg of terlipressin

Cirrhotic cardiomyopathy (CC)

Left ventricular ejection fraction evaluated by MRI before and after the administration of dobutamine (5-40 μg/kg/min)

10 μg/kg/min  
10 μg/kg/min

Cirrhotic cardiomyopathy (CC)

Left ventricular ejection fraction before and after the exercise in patients with alcohol- and non alcohol-related cirrhosis

\[ P = \text{N.S.} \]

\[ P = \text{N.S.} \]

Cirrhotic cardiomyopathy (CC)

Heart rate before and after the exercise in patients with alcohol- and non alcohol-related cirrhosis

Cirrhotic cardiomyopathy (CC)

Agenda

• Definition

• Pathogenesis

• Diagnosis

• Clinical aspects
  • Diastolic dysfunction

• Treatment
Cirrhotic cardiomyopathy (CC)

Prevalence of diastolic dysfunction in patients with cirrhosis


P < 0.001
Cirrhotic cardiomyopathy (CC)

Relationship between the degree of reduction of the effective blood volume and left ventricular diastolic dysfunction (LVDD)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Patients without ascites (n° =26)</th>
<th>Patients with ascites without renal failure (n° =59)</th>
<th>Patients with ascites with renal failure (n° =15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HR (bpm)</td>
<td>77 ± 10</td>
<td>82 ± 12</td>
<td>82 ± 10</td>
</tr>
<tr>
<td>MAP (mm Hg)</td>
<td>91 ± 7</td>
<td>83 ± 10</td>
<td>75 ± 16**</td>
</tr>
<tr>
<td>PRA (ng/ml/h)</td>
<td>0.7 ± 1.6</td>
<td>2.5 ± 1.1</td>
<td>8.0 ± 10.0**</td>
</tr>
<tr>
<td>Norepinephrine (pg/ml)</td>
<td>226.0 ± 155.0</td>
<td>363.0 ± 241.0</td>
<td>669.0 ± 571.0**</td>
</tr>
<tr>
<td>LVDD grade 0</td>
<td>15 (57%)</td>
<td>19 (32%)</td>
<td>7 (19.5%)</td>
</tr>
<tr>
<td>LVDD grade 1</td>
<td>7 (27%)</td>
<td>31 (53%)</td>
<td>8 (53%)</td>
</tr>
<tr>
<td>LVDD grade 2</td>
<td>4 (16%)</td>
<td>9 (15%)</td>
<td>3 (20%)</td>
</tr>
</tbody>
</table>

A. Nazar et al. J. Hepatol. 213; 58: 51–57
Cirrhotic cardiomyopathy (CC)

Relationship between the degree of reduction of the effective blood volume, evaluated by plasma renin activity (PRA), and left ventricular diastolic dysfunction (LVDD)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Patients without ascites (n° =26)</th>
<th>Patients with ascites and normal PRA (n° =18)</th>
<th>Patients with ascites and increased PRA (n° = 36)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HR (bpm)</td>
<td>78 ± 10</td>
<td>76 ± 15</td>
<td>78 ± 13</td>
</tr>
<tr>
<td>MAP (mm Hg)</td>
<td>90 ± 7</td>
<td>84 ± 8°</td>
<td>78 ± 8****</td>
</tr>
<tr>
<td>CTP score</td>
<td>7 ± 1</td>
<td>10 ± 1° ° ° °</td>
<td>10 ± 2**</td>
</tr>
<tr>
<td>MELD score</td>
<td>12 ± 5</td>
<td>16 ± 4° ° ° °</td>
<td>19 ± 6**</td>
</tr>
<tr>
<td>PRA (ng/ml/h)</td>
<td>2.0 ± 1.6</td>
<td>2.5 ± 1.1</td>
<td>7.0 ± 3.0****###</td>
</tr>
<tr>
<td>Aldosterone (ng/dl)</td>
<td>28.2 ± 24.5</td>
<td>55.4 ± 59.0</td>
<td>98.0 ± 69.0****#</td>
</tr>
<tr>
<td>Norepinephrine (pg/ml)</td>
<td>238.5 ± 63.2</td>
<td>293.0 ± 125.2</td>
<td>584.0 ± 262.3****#####</td>
</tr>
<tr>
<td>LVDD grade 0</td>
<td>20 (77%)</td>
<td>16 (89%)</td>
<td>7 (19.5%)</td>
</tr>
<tr>
<td>LVDD grade 1</td>
<td>5 (19%)</td>
<td>2 (11%)</td>
<td>12 (33.3%)*#</td>
</tr>
<tr>
<td>LVDD grade 2</td>
<td>1 (4%)</td>
<td>0 (0%)</td>
<td>17 (47.2%)****####</td>
</tr>
</tbody>
</table>

Cirrhotic cardiomyopathy (CC)

Independent predictors for the development of type 1 HRS

<table>
<thead>
<tr>
<th>Variables</th>
<th>RR</th>
<th>95% CI</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRA (ng/ml/h)</td>
<td>1.24</td>
<td>1.0-1.5</td>
<td>0.0013</td>
</tr>
<tr>
<td>E/e’ ratio</td>
<td>1.55</td>
<td>1.2±2.0</td>
<td>0.002</td>
</tr>
</tbody>
</table>

*L. Ruiz-del-Arbor et al. Hepatology 2013; 58: 1732-1741*
Cirrhotic cardiomyopathy (CC)

Probability of survival in patients with and without diastolic dysfunction

A. Nazar et al. J. Hepatol. 213; 58: 51–57
Cirrhotic cardiomyopathy (CC)

Probability of survival in patients with and without diastolic dysfunction

Cirrhotic cardiomyopathy (CC)

El Clasico
Cirrhotic cardiomyopathy (CC)

Left ventricular ejection fraction according to the grade of diastolic dysfunction

A. Nazar et al. J. Hepatol. 213 ; 58 : 51–57
Cirrhotic cardiomyopathy (CC)

Left ventricular ejection fraction according to the grade of diastolic dysfunction

P < 0.001

Cirrhotic cardiomyopathy (CC)

Cardiac output according to the grade of diastolic dysfunction

\[ P < 0.001 \]

### Systemic hemodynamics before and after the onset of HRS after the resolution of SBP

<table>
<thead>
<tr>
<th></th>
<th>HRS after SBP resolution</th>
<th>No HRS after SBP resolution</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAP (mm Hg)</td>
<td>73±8</td>
<td>83±8</td>
<td>&lt; 0.025</td>
</tr>
<tr>
<td>SVR (dyn sec/cm²)</td>
<td>1268±320</td>
<td>968±226</td>
<td>N.S.</td>
</tr>
<tr>
<td>Plasma NE (pg/ml)</td>
<td>1290.5±415.3</td>
<td>317.±195.3</td>
<td>&lt;.025</td>
</tr>
<tr>
<td>CO (l/min)</td>
<td><strong>4.6±0.7</strong></td>
<td><strong>6.8±2.0</strong></td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>RAP (mm Hg)</td>
<td>4.6±2.7</td>
<td>4.1±1.7</td>
<td>N.S.</td>
</tr>
<tr>
<td>PCWP (mm Hg)</td>
<td>7.4 ±2.6</td>
<td>7.0±2.3</td>
<td>N.S.</td>
</tr>
<tr>
<td>HR (bpm)</td>
<td>87±9</td>
<td>79±16</td>
<td>N.S.</td>
</tr>
</tbody>
</table>

Cirrhotic cardiomyopathy (CC)

Agenda

• Definition
• Pathogenesis
• Diagnosis

• Clinical aspects
  • Diastolic dysfunction
  • Systolic dysfunction
  • Electromechanical abnormalities

• Treatment
Cirrhotic cardiomyopathy (CC)

Heart/plasma norepinephrine in patients with cirrhosis according to the degree of reduction of effective arterial blood volume

Cirrhotic cardiomyopathy (CC)

Response of isolated atria to isoproterenol in rats with cirrhosis treated with saline or L-NAME

AR. Mani et al. Hepatology 2006; 43: 847-856
Cirrhotic cardiomyopathy (CC)

Commonest ECG abnormalities in patients with cirrhosis at pre-transplant evaluation

<table>
<thead>
<tr>
<th>Abnormalities</th>
<th>Patients with cirrhosis (n° =186)</th>
<th>Controls (n° 92)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prolonged QT interval</td>
<td>57 (31.5%)</td>
<td>8 (8%)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Abnnormal QRS axis deviation</td>
<td>39 (21%)</td>
<td>10 (10%)</td>
<td>&lt; 0.025</td>
</tr>
<tr>
<td>Compatible with CAD</td>
<td>40 (17%)</td>
<td>5 (5%)</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>

*A. Josefsson et al. BMC Gastroenterol. 2014; 14: 65*
Cirrhotic cardiomyopathy (CC)

QT prolongation in patients with cirrhosis

<table>
<thead>
<tr>
<th>Variables</th>
<th>Patients with cirrhosis and QT prolongation (n° =61)</th>
<th>Patients with cirrhosis without QT prolongation (n° =68)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>57.3 ± 10.77</td>
<td>56.0 ± 11.5</td>
<td>N.S.</td>
</tr>
<tr>
<td>Gender (M/F)</td>
<td>37/24</td>
<td>50/18</td>
<td>N.S.</td>
</tr>
<tr>
<td>Etiology (Alcoholic/Non Alcoholic)</td>
<td>25/37</td>
<td>25/42</td>
<td>N.S.</td>
</tr>
<tr>
<td>Ascites (yes/no)</td>
<td>22/33</td>
<td>9/51</td>
<td>&lt; 0.025</td>
</tr>
<tr>
<td>Renal failure (yes/no)</td>
<td>9/52</td>
<td>0/68</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>MAP</td>
<td>91.6 ± 11.4</td>
<td>95.2 ± 13.2</td>
<td>N.S.</td>
</tr>
<tr>
<td>HR</td>
<td>72.6 ± 11.1</td>
<td>6.3 ± 1.7</td>
<td>N.S.</td>
</tr>
<tr>
<td>CTP score</td>
<td>7.6 ± 2.4</td>
<td>6.3 ± 1.7</td>
<td>&lt; 0.025</td>
</tr>
<tr>
<td>MELD score</td>
<td>20.0 ± 24.3</td>
<td>11.3 ± 12.5</td>
<td>&lt; 0.025</td>
</tr>
</tbody>
</table>

1. Angeli et al. (unpublished data)
Cirrhotic cardiomyopathy (CC)

Actuarial survival of cirrhotic patients categorized according to the number of independent risk factors of death (MELD ≥ 20 and QTc interval ≥ 460 ms) at the bleeding time

F. Trevisani et al. Liver Int. 2012; 32: 1510-1515
Cirrhotic cardiomyopathy (CC)

**Agenda**

- Definition
- Pathogenesis
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- Treatment
  - What should we use cautiously?
Cirrhotic cardiomyopathy (CC)

Potential deleterious effect of $\beta$-blockers on survival in patients with cirrhosis and refractory ascites

$T. \text{Sestré et a. Hepatology 2010 ; 52 : 1017-1022.}$
Cirrhotic cardiomyopathy (CC)

Systemic hemaodynamics according to the stage of cirrhosis

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Control subjects (n° = 46)</th>
<th>Pts with cirrhosis without ascites (n° = 36)</th>
<th>Pts with cirrhosis and responsive ascites (n° = 31)</th>
<th>Pts with cirrhosis and refractory ascites (n° = 46)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart rate (beat/min)</td>
<td>67±10</td>
<td>70±10</td>
<td>68±11</td>
<td>78±13*#</td>
</tr>
<tr>
<td>Mean arterial pressure (mm Hg)</td>
<td>97±7</td>
<td>99±10</td>
<td>96±11</td>
<td>87±9*##</td>
</tr>
<tr>
<td>Systemic vascular resistance (din s/cm²m)</td>
<td>3371±648</td>
<td>2925±641***</td>
<td>2860±776***</td>
<td>2439±573***#</td>
</tr>
<tr>
<td>Stroke volume (ml/beat)</td>
<td>64±10</td>
<td>75±12**</td>
<td>77±11**</td>
<td>73±17**</td>
</tr>
<tr>
<td>Cardiac output (L/min)</td>
<td>4.27±0.80</td>
<td>5.28±1.11***</td>
<td>5.29±1.42***</td>
<td>5.60±1.50***</td>
</tr>
</tbody>
</table>

* = p < 0.01 ; ** = p < 0.001 ; *** = p < 0.001 versus control subjects ; # = p < 0.05 ; ## = < 0.001 versus other groups of patients with cirrhosis

Cirrhotic cardiomyopathy (CC)

Effect of large volume paracentesis on heart rate in patients treated or not with β-blockers

**β-blockers**

**No β-blockers**

---

Cirrhotic cardiomyopathy (CC)

Effect of large volume paracentesis on plasma renin concentration in patients treated or not with β-blockers

β-blockers

No β-blockers

Cirrhotic cardiomyopathy (CC)

Effect of nonselective β-blockers (NSBB) on transplant free survival in patients with spontaneous bacterial peritonitis (SBP)

M. Mandofer et al. Gastroenterology 2014 ; 146: 1680-1690
Cirrhotic cardiomyopathy (CC)

The Non selective Beta-Blockers (NSBB) window in patients with cirrhosis

P.S. Ge et al. Gastroenterology 2014; 146: 1597-1599
Cirrhotic cardiomyopathy (CC)

Effect of β-blockers on death in patients with cirrhosis and ascites listed for liver transplantation

Cirrhotic cardiomyopathy (CC)

Effect of β-blockers on survival in patients with acute on chronic liver failure

Cirrhotic cardiomyopathy (CC)

Riopen the window for beta-blockers in patients with cirrhosis?

G. Garcia-Tsao J Hepatol. 2016; 64: 532-534
Cirrhotic cardiomyopathy (CC)

Use of Non Selective Beta-Blockers (NSBB) in patients with end-stage liver disease

- In patients with cirrhosis and refractory ascites NSBB should be used cautiously with close monitoring of blood pressure, serum sodium and serum creatinine.
- Until randomized trials are available NSBB should be reduced/discontinued if a patient with refractory ascites develops any of the following events:
  ★ Systolic blood pressure < 90 mmHg
  ★ Hyponatremia (< 130 mEq/L)
  ★ Acute kidney injury
- If NSBB are stopped endoscopic band ligation should be performed.

*R. De Franchis et al. J. Hepatol. 2015 ; 63 : 743-752*
Cirrhotic cardiomyopathy (CC)

Drugs known to prolong QT interval

• Antibiotics
  – Macrolides
  – Fluoroquinolones

• Antipsycotic agents
  – Haloperidol
  – Chlorpromazine

• Drugs acting on gastrointestinal motility
  – Domperidone
  – Cisapride

• Other drugs
  – Calcium channel blockers
  – Sotalol (HR)
  – Quinidine (HR)
  – Methadone
  – Amiodarone

Cirrhotic cardiomyopathy (CC)

Agenda

• Definition

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  • What should we use cautiously?
  • What could we use?
Cirrhotic cardiomyopathy (CC)

Cardiac output in cirrhotic patients according to the Child-Pugh-Turcotte class

(ml/min)

* = P < 0.025  * * = P < 0.01

Recovery of renal function according to the use of albumin

MANAGEMENT OF PATIENTS WITH CIRRHOSIS

Systemic hemodynamics at baseline and 30 min. after i.v. terlipressin in patients with cirrhosis and ascites

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Baseline</th>
<th>After terlipressin</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart rate (bpm)</td>
<td>83 ± 16</td>
<td>72 ± 16</td>
<td>&lt; 0.005</td>
</tr>
<tr>
<td>Mean arterial pressure (mm Hg)</td>
<td>89 ± 11</td>
<td>105 ± 14</td>
<td>&lt; 0.005</td>
</tr>
<tr>
<td>Systemic vascular resistance (dynes/s · cm$^5$)</td>
<td>1295 ± 293</td>
<td>1653 ± 465</td>
<td>&lt; 0.005</td>
</tr>
<tr>
<td>Cardiac output (l/min)</td>
<td>5.2 ± 1.0</td>
<td>4.9 ± 1.1</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>Pulmonary capillary wedged pressure (mm Hg)</td>
<td>9.6 ± 3.1</td>
<td>12.3 ± 2.6</td>
<td>&lt; 0.005</td>
</tr>
</tbody>
</table>
Cirrhotic cardiomyopathy (CC)

Effects of albumin on cardiac contractility in cirrhotic rats

A. Bortoluzzi et al. Hepatology 2013; 57: 266-276
Cirrhotic cardiomyopathy (CC)

Effects of albumin on TNF-α protein expression in the cardiac tissue according to treatment with saline (S) or albumin (A)

* p<0.05 vs controls

# p<0.05 vs rats with cirrhosis treated with S

A. Bortoluzzi et al. Hepatology 2013 ; 57 : 266-276
Cirrhotic cardiomyopathy (CC)

Effects of albumin on iNos protein expression in the cardiac tissue according to treatment with saline (S) or albumin (A)

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Cirrhotic cardiomyopathy (CC)
Cirrhotic cardiomyopathy (CC)

Summary

- CC, fully defined, is quite common in patients with cirrhosis.
- It is characterized by cardiac inflammation and fibrosis leading to cardiac hypertrophy.
- Inflammation of the cardiac tissue is due to both the overactivity of the renin-angiotensin-aldosterone system and the systemic pro-inflammatory state linked to bacterial translocation.
- DD should be diagnosed by TDI on the basis of E/e’ ratio.
- Suclinical SD should be detected by a dynamic test that, however, should be still validated.
- DD usually evolves toward SD so contributing to the development of hepatorenal syndrome.
- CC should be taken into account for therapeutical decisions in patients with cirrhosis.