Athletes and LVNC: The gray zone

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LV Non Compaction

Double layer appearance of the myocardium with a non compacted layer and a thinner compact layer.

Thought to be secondary to an arrest of the compaction process of the LV during the embryonic development.

Unfavorable outcome in childhood. Variable outcome in the adulthood.
LVNC: Outcome

Arrhythmias
Incidence: 0 to 9% over follow-up

Sudden Death
Incidence: 1 to 18% over follow-up

Ottaviani et al Cardiovasc Pathology 2016
LV Non Compaction

Diagnosis of LVNC over time

- Symptomatic
- Asymptomatic

(Modified from: Greutmann et al Am J Cardiol 2012)
LVNC in athletes

1146 athletes and 415 controls
Between 2003 and 2011

8% athletes had positive criteria for LVNC

Gati et al. Heart 2013
LVNC in athletes

- Epiphenomenon of cardiac adaptations
- Mild phenotypic expression of the disease?
Epiphenomenon of Cardiac adaptations

- Congenital Heart Disease
- Aortic stenosis
- Heart Failure
- Pregnancy
- Athletes
- Sickle cell anemia
Epiphenomenon of Cardiac adaptations

Pregnant women

- 25% developed trabeculations
- 70% complete resolution over FU
- 30% delayed regression of trabeculations

Gati S, Sharma S, Circulation 2014
Epiphenomenon of Cardiac adaptations

Before Training

Peak Training

Detraining

5 months

1 Year

D’Ascenzi et al Int J Cardiol 2014
The new Gray-Zone

Athlete

LVNC
Clinical evaluation

- Personal and family history
- 12-leads ECG
- Arrhythmic burden
- Cardiac Imaging
Clinical case

- 18 yo female athlete.
- Basketball player
- National level
- Referred for hypertrabeculation
1 – Family Hx and Clinical Ex

- Sudden death
- Dilated Cardiomyopathy
- Hypertrophic cardiomyopathy
- Unexplained Syncope
- Palpitation
- Extra-cardiac conditions
- Abnormal heart sounds
3 – Arrhythmic burden

- Excellent exercise capacity
- Normal BP response
- No ECG abnormalities
- No arrhythmias
3 – Arrhythmic burden

- 24-h ECG Holter

24 Hours ECG monitoring:

- Few isolated PVCs with LBBB pattern
ECHO measurements

- LV diameter: 49mm
- LV wall thickness: 10mm
- EF: 58%
- E/A: 2.3
- PASP: 25mmHg
4 – Cardiac Imaging

X/Y = 0.30

N/C = 2.2
4 – Cardiac Imaging

CMR

- Normal LV volumes
- Normal LV wall thickness
- Normal LV systolic function
- Increased LV trabeculation.
- No areas of hypernahnancement.
Clinical evaluation

- Personal and family history [not completed]
- 12-leads ECG [not completed]
- Arrhythmic burden [not completed]
- Cardiac Imaging [completed]
Recommendations

No sport restriction, periodic follow-up

- No clinical events.
- No arrhythmias
- No changes in LV morphology and function
- High levels of achievements

5 Years follow-up
Clinical evaluation

Prognostic significance of trabeculations in athletes?
Prognostic significance

MESA Study
2742 participants (healthy): Serial CMR scans from 2000 to 2010

20% of patients had N/C from 2.46 to 5.41

Over 10 years retrospective FU no changes in LV volumes and function

Zamrak F et al J Am Coll Cardiol 2014
Corrado D et al 2003
Maron BJ et al 2009
Drezner 2009
Harmon 2011
Roberts 2013
Harmon 2014
Maron BJ et al 2014

No reported cases of SCD in athletes due to LVNC
The Italian experience

2501 Olympic Athletes
From 2012 to 2015

Normal LV morphology, n=2465

Athletes with Prominent Trabeculations: n = 36 (1.4%)
The Italian experience

36 Athletes with Prominent Trabeculations

- LVNC unlikely
  - N = 9
  - 3 T wave inversion
  - 3 Borderline EF
  - 2 Arrhythmias
  - 1 Palpitations

- LVNC N = 3
  - 2 with reduced EF
  - 1 had + Family Hx

- LVNC excluded
  - N = 24
  - Prominent trabeculations were isolated

Caselli S et al Int J Cardiol 2016
### Echocardiography

<table>
<thead>
<tr>
<th></th>
<th>No LVNC</th>
<th>LVNC Unlikely</th>
<th>LVNC</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>N of NC segments</td>
<td>4 ± 2</td>
<td>7 ± 4</td>
<td>6 ± 3</td>
<td>0.066</td>
</tr>
<tr>
<td>Minimal thickness in systole</td>
<td>7 ± 1</td>
<td>7 ± 1</td>
<td>5 ± 1</td>
<td>0.035</td>
</tr>
<tr>
<td>Positive Chin (X/Y &lt; 0.5)</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>-</td>
</tr>
<tr>
<td>Positive Jenni (N/C &gt; 2)</td>
<td>17%</td>
<td>22%</td>
<td>67%</td>
<td>&lt;0.05</td>
</tr>
</tbody>
</table>
LVNC criteria in asymptomatic athletes

Left Ventricular Function

EF > 55%
- Negative family history
- Normal LV diastolic function
- No ECG abnormalities
- No arrhythmias/syncope
- NO LVNC
  - No restriction for sport participation.
  - Follow-up advised

EF < 55%
- Positive family history
- ECG abnormalities
- Ventricular tachyarrhythmias
- CMR with LGE
- Genetic testing
- Normal CMR and negative genetic testing:
  - LVNC unlikely.
  - Sport participation allowed, with periodic follow-up
- Positive CMR and/or genetic testing:
  - LVNC likely.
  - Restrict sport participation

Caselli S, Am J Cardiol 2015
LVNC is still a largely undefined cardiomyopathy

Full phenotypic expression is associated with adverse outcome

Isolated trabeculations are of uncertain significance

Final decision after careful consideration of the overall clinical picture
Thank You