On a single routine electrocardiogram:

1 of 100 *amateur* athletes has extrasystoles.\(^1\)
2 of 100 *trained* athletes have extrasystoles.\(^2\)

\(^1\)Pelliccia, *Eur Heart J* 2007  \( ^2\)Biffi, *JACC* 2002

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**The Cardiologist’s Worst Nightmare:**

Sudden Death from BENIGN Ventricular Arrhythmias.

Sami Viskin, M.D.
Tel Aviv Medical Center.
2009

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Irresistible
The urge to do Holters

Holter in athletes:
- 33% have PVCs
- 12% frequent PVCs
- 7% NSVT

27-year-old soccer player. Non-invasive tests ➔ no heart disease


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E.N.  
F/50  
Palpitations  
Normal echo

II
aVF
V2
V4
V5
V6

II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6
Maximal exercise test H.R. 172/min

Discharged with beta-blockers.

Stopped beta-blockers to do a Thallium scan.
A 47 years-old woman had this for 15 years……

….and then had this:

Viskin, J Cardiovasc Electrophysiol 2005

The “short-coupled variant” of RVOT-VT

Viskin, JCE 2005.

Malignant RVOT-VT

Idiopathic VF ?

Viskin, Mode of onset of idiopathic VF. JCE 1997
Onset of VF in idiopathic VF: Always the same

First episode.

Second episode.

64-year old woman: Palpitations and recurrent syncope over 2 months

Onset of polymorphic VT in idiopathic VF: Always the same

Mapping and Ablation of Idiopathic Ventricular Fibrillation

Mehdi Hejazi, MD, Mario Sbath, MD, Pierre Lefa, MD, Akiko Nomura, MD,
Dipen C. Shah, MD, Joseph Kottkian, MD, Thomas Arritz, MD, Dietrich Kubiche, MD,
Dominique Laumonier, MD, Mike Griffith, MD, Fernando Cruz, MD, Angelo de Paolis, MD,
Umberto Gobbi, MD, Michele Hocini, MD, Stephane Guignard, MD, Lucien Mclauchlin, MD,
Rahshahn Weseewy, MD, Jacques Clementy, MD

Triggers of idiopathic VF = 85% left Purkinje areas; 15% RVOT
**Malignant Polymorphic VT originating from the RVOT**

(n=16 out of 101 RVOT referred for RF ablation)


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**Malignant entity of polymorphic VT originating in the RVOT.**

<table>
<thead>
<tr>
<th></th>
<th>Polymorphic RVOT-VT (n=16)</th>
<th>Monomorphic RVOT-VT (n=85)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>56%</td>
<td>71%</td>
</tr>
<tr>
<td>Age</td>
<td>39 ± 10</td>
<td>43 ± 14</td>
</tr>
<tr>
<td>Symptoms</td>
<td>80 months</td>
<td>70 months</td>
</tr>
<tr>
<td>Syncope</td>
<td>69%</td>
<td>18%</td>
</tr>
<tr>
<td>PVC/day</td>
<td>17,000</td>
<td>15,000</td>
</tr>
<tr>
<td>Coupling interval</td>
<td>409 ± 62</td>
<td>428 ± 65</td>
</tr>
</tbody>
</table>

---

**Malignant Polymorphic VT originating from the RVOT.**

Warning
Leave the room now!

The next case will scare you

A patient with typical vagal-syncope and extrasystoles…….

Typical vagal syncope during venipuncture

Same patient... arrhythmias recorded during a tilt-table test.

Kataoka, Nature Cardiovascular Medicine 2008
Coupling interval of the ventricular extrasystoles (Mean ± S.D. in msec.)

- **Malignant RVOT-VT**
  - Mean: 471 ± 347 msec
  - Mean: 330 ± 260 msec

- **Benign RVOT-VT**
  - Mean: 360 ± 363 msec

- **Idiopathic VF**

- **CPVT ?**

Exercise test: Stage I

Exercise test: Stage III
The first VT-complex in CPVT most commonly originates in the RVOT


Sumitomo, Heart 2003.

Beta-blockers + calcium-blockers vs. beta-blockers alone in children with CPVT.

A Baseline
B Propranolol
C No medications
D Propranolol + verapamil

300 beats/min

Onset of PVT
50 years-old marathon runner

Maximal exercise (no drugs) Maximal exercise (no drugs)

6 years-old with CPVT: No medications

Unraveling of Epsilon waves

Baseline Catheter-induced RBBB Atrial pacing

Epsilon

Upper panel: 50 years-old marathon runner

Upper panel: 6 years-old with CPVT: No medications

Table:

<table>
<thead>
<tr>
<th>Baseline</th>
<th>Catheter-induced RBBB</th>
<th>Atrial pacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1</td>
<td>V1</td>
<td>V1</td>
</tr>
<tr>
<td>V2</td>
<td>V2</td>
<td>V2</td>
</tr>
<tr>
<td>V3</td>
<td>V3</td>
<td>V3</td>
</tr>
</tbody>
</table>

Graphs:

Graph A: Maximal exercise (no drugs)

Graph B: Unraveling of Epsilon waves

Graph C: Baseline

Graph D: Catheter-induced RBBB

Graph E: Atrial pacing
Voltage mapping in patients with RVOT-VT and apparently normal heart reveals ARVD in 7/27 patients who underwent CARTO-mapping because of “suspicious clinical findings.”


ARVD: Sustained monomorphic VT 260/min

Short-coupled PVCs in a patient with arrhythmic storm.
One beat, one diagnosis.

VF despite ventricular pacing at 125 beats/min.

The next day...

Day #2: During intravenous isoproterenol and procainamide plus quinidine via gastric tube
Short-coupled PVCs during syncope.
The Cardiologist’s Worst Nightmare:

Incidental Finding of Short coupled PVCs in the Asymptomatic Patient

Ventricular ectopics with varying coupling interval (Parasystole)... really benign?

Recorded 2 years ago..... So far so good......
THANK YOU

Have pleasant dreams..