EXERCISE RELATED ARRHYTHMIAS - ASSOCIATED CONDITIONS

- Normal cardiopulmonary status
- Coronary artery disease
- Cardiomyopathy - Congestive - Hypertrophic
- Aortic valvular stenosis
- Long QT interval syndromes - Congenital - Acquired
- ARVC
- Mitral valve prolapse
- Drugs (e.g., digitalis, flecainide)
- Electrolyte abnormalities (e.g., K⁺, Mg++)
- Chronotropic incompetence
- Pacemaker-related rhythms - Rapid paced rates - Electronic Wenckebach, 2:1 AVB

MECHANISMS OF EXERCISE VT

- Ischemia
- ↑ sympathetic tone
- ↓ vagal tone
- Abnormal automaticity
- Reentry
- Abnormal triggering
EXERCISE-INDUCED VENTRICULAR ARRHYTHMIAS IN NORMAL MEN (N = 144)

- PVC, unifocal
- PVC, multifocal
- VT

PROSPECTIVE STUDIES SHOWING NO RELATIONSHIP OF VA DURING EXERCISE TESTING TO CARDIAC OR ARRHYTHMIC EVENTS IN ASX SUBJECTS

<table>
<thead>
<tr>
<th>Yr</th>
<th>N</th>
<th>FU (yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blackburn et al</td>
<td>1970</td>
<td>12,770</td>
</tr>
<tr>
<td>Rodstein</td>
<td>1971</td>
<td>62</td>
</tr>
<tr>
<td>McHenry</td>
<td>1976</td>
<td>64</td>
</tr>
<tr>
<td>Froelicher</td>
<td>1974</td>
<td>488</td>
</tr>
<tr>
<td>Faris</td>
<td>1976</td>
<td>543</td>
</tr>
</tbody>
</table>

VENTRICULAR ARRHYTHMIAS DURING EXERCISE TESTING

- Prevalence: 3 - 45%

<table>
<thead>
<tr>
<th>PVC TYPE</th>
<th>Any</th>
<th>Complex / Frequent</th>
<th>NSVT / VT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normals</td>
<td>10 - 40%</td>
<td>3 - 11%</td>
<td>2 - 8%</td>
</tr>
<tr>
<td>LV dysfxm:</td>
<td>30 - 50%</td>
<td>23 - 37%</td>
<td>8 - 15%</td>
</tr>
</tbody>
</table>
- with age
- with increasing HR
- Reproducibility poor
- No definite relationship to sudden death independent of underlying heart disease
CLINICAL CORRELATES AND PROGNOSIS OF EXERCISE VEA:

- N = 792 (27% of offspring), FU 15 yr
- Correlates: age, HT, male
- Not related to ST response, EF, PVC grade
- HR 1.86 for all cause death, but no association with CHD events (MI, death)
- Low annual death rates, low risk pts

* No. PVCs/min Ex; “frequent” = PVCs > median value


EXERCISE-INDUCED PVCs AND DEATH

<table>
<thead>
<tr>
<th></th>
<th>Cumulative incidence (%)</th>
<th>years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequent VPBs</td>
<td>8</td>
<td>15</td>
</tr>
<tr>
<td>Infrequent VPBs</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>No VPBs</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

Unadjusted annual death rates:

- without VPBs: 2.68
- infrequent: 5.02
- frequent: 6.98


PROBLEMS WITH STUDIES OF EXERCISE INDUCED VENTRICULAR ARRHYTHMIAS

- Mostly men
- Patient population differences (asx, CAD known/suspected, etc.)
- Differing endpoints (all cause vs. CAD/CHF mortality vs. nonfatal CAD events)
- Inclusion of rest ectopy
- “Frequent” PVCs variably defined
- Grades of PVCs not always specified
Exercise-induced RVOT VT

LQTS with TU alternans
PREDICTIVE ACCURACY FOR CAD OF INTRAVENTRICULAR CONDUCTION DELAYS AND SUPRAVENTRICULAR ARRHYTHMIAS IN AN ASYMPTOMATIC POPULATION

<table>
<thead>
<tr>
<th></th>
<th>Prevalence</th>
<th>Predictive accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>RBBB</td>
<td>0.2%</td>
<td>20%</td>
</tr>
<tr>
<td>LBBB</td>
<td>0.1%</td>
<td>24%</td>
</tr>
<tr>
<td>AF, other</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SV arrhythmias</td>
<td>0.1%</td>
<td>14%</td>
</tr>
</tbody>
</table>

Froelicher, et al    AJC 1.77    N = 298
EXERCISE-INDUCED SUPRAVENTRICULAR ARRHYTHMIAS IN NORMALS

- Prevalence 6%
- Relation to age (men)
- 98% are paroxysmal
- 16% are > 10 beats
- Symptoms in 4%
- Most (44%) episodes occur at peak effort

Mauer et al, Baltimore Aging Study, AJC 4.95
843 men, 540 women; FU mean 6 yr

FLECAINIDE Rx REST
EXERCISE INDUCED ATRIAL ARRHYTHMIAS

Bunch et al  JACC 2004; 43:1236
Mayo Clinic  N = 5375  CAD known/suspected

Survival free of MACE (%)

P = 108

EXERCISE INDUCED ATRIAL ARRHYTHMIAS

Bunch et al  JACC 2004; 43:1236
Mayo Clinic  N = 5375  CAD known/suspected

* Death, MI, revasc
BUNDLE BRANCH BLOCK IN TREADMILL TESTING

• Predictive accuracy depends on prevalence of coronary disease in population studied.
  + PA is about 20% in axx subjects
• Predictive accuracy of intermittent, rate-dependent and newly acquired BBB is unknown
• Criteria for ischemia apply in lateral leads in RBBB, not in LBBB, although sensitivity is reduced due to the secondary ST-T abnormalities
Rate-dependent LBBB

REST

STAGE V/100

REC: 2 min
VAGAL BRADYCARDIA DURING TREADMILL EXERCISE
• Uncommon
• Usually young, healthy, active individuals
• Abrupt bradycardia-hypotension at peak exercise or during recovery
  - Often without warning
  - May be associated with syncope
• Rapid recovery without sequelae
• May be related to stimulation of left ventricular mechanoreceptors
• May be reproducible
• Does not indicate sinus node dysfunction

35 y.o. axx male with WPW conduction: vagal response to exhaustive exercise
EXERCISE-INDUCED AV BLOCK

- Occurs in < 1% of all exercise tests
- Usually intra-His (QRS normal) or infra-His (BBB at rest)
- High (> 90%) rate of progression to chronic AV block
- Cardiac pacing indicated

56 y.o. male, post-aortocoronary bypass surgery 3 yr prior, developed ill feeling with effort
62 y.o. male - trifascicle disease