Sports Participation in Patients with Known Heart Disease

Ravi Mandapati, M.D., FACC., FHRS
Director, Specialized Program for Arrhythmias in Congenital Heart Disease
UCLA Cardiac Arrhythmia Center
David Geffen School of Medicine at UCLA
Director, Pediatric Cardiac Electrophysiology
Loma Linda University Medical Center
Outline

- Sports and SCD: Scope of problem
- Sports and Inherited disorders (GCVD)
- Sports and congenital heart disease
- Guidelines

Restrictions

- What is the basis for restrictions
  – Data is scarce
- Definition of Competitive vs recreational sports
- Liability concerns
- Genotype positive phenotype negative patients
- AICD’s
Causes of SCD under 40 years

Causes of Sudden Death at autopsy in 387 High School Athletes

- Asthma (8)
- Heat Stroke (6)
- Drug abuse (4)
- Other CV (4)
- LQTS (3)
- Sarcoid (3)
- Cardiac trauma (3)
- Rupt cerebral artery (3)
- HCM (102)
- Commotio Cordis (77)
- LVH (29)
- Coronary anomalies (53)

Causes of SCD in young athletes in the Veneto region of Italy

- Conduction system disease: 8.2%
- Pulmonary Embolus: 2%
- Hypertrophic CM: 2%
- Anomalous Coronary Artery: 12.2%
- Mitral Valve Prolapse: 10.2%
- Myocarditis: 6.1%
- Dissecting aortic aneurysm: 2%
- Dilated Cardiomyopathy: 2%
- RV Cardiomyopathy: 22.4%
- Coronary atherosclerosis: 18.4%
- Myocardial bridging: 4.1%
- Hypertrophic CM: 2%
- Dilated Cardiomyopathy: 2%
- Coronary atherosclerosis: 18.4%
- Myocardial bridging: 4.1%

Impact of ECG based pre-participation screening programme in Veneto region of Italy

- 2,009,600 persons in Veneto region of Italy < 35 years old
- 269 sudden unexpected cardiac deaths (49 athletes and 220 nonathletes)
- 33,735 athletes underwent 73,718 screenings
- 3,016 (8.9%) required echocardiograms
- 1,058 disqualified, 621 (1.8%) for cardiac reasons;
  - HTN: 27.1%
  - PVCs / VT: 9.5%
  - SVTs: 7.6%
  - WPW: 7.1%
  - HCM: 3.5%
  - LBBB or RBBB / LAD: 1.9%
  - AVB: 1.6%
  - Long QT: 0.6%
Absolute Risk of Sudden Cardiac Death During Exertion in Men versus Women

<table>
<thead>
<tr>
<th>Risk of SCD during moderate/vigorous exertion:</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 SCD per 2.8 million person-hours at risk</td>
<td></td>
<td>1 SCD per 17.9 million person-hours at risk</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Risk of SCD during lesser or no exertion:</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 SCD per 23 million person-hours.</td>
<td></td>
<td>1 SCD per 66 million person-hours.</td>
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<tr>
<th>Risk Difference:</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 excess SCD per 3.2 million person-hours</td>
<td></td>
<td>1 excess SCD per 24.5 million person-hours</td>
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</table>

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<tr>
<th>Attributable Risk Percent</th>
<th>Men</th>
<th>Women</th>
</tr>
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<tbody>
<tr>
<td>88%</td>
<td></td>
<td>73%</td>
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Classification of Sports

- **Type of exercise**
  - Dynamic
  - Static
- **Level on intensity**
  - Competitive vs recreational
- **Danger of bodily collision**

January 14-15, 2011 SCA Conference
**Definitions**

- **Dynamic exercise** – Changes in muscle length and joints with rhythmic contractions and little intramuscular force
- **Static exercise** – large intramuscular force with little or no change in muscle length

**CLASSIFICATION OF SPORTS**

<table>
<thead>
<tr>
<th>Increasing Static Component</th>
<th>III. High (&gt;50% MVC)</th>
<th>II. Moderate (20-50% MVC)</th>
<th>I. Low (&lt;20% MVC)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bobsledding/Luge†, Field events (throwing), Gymnastics†, Martial arts*, Sailing, Sport climbing, Water skiing†, Weight lifting†, Windsurfing†</td>
<td>Body building†, Downhill skiing†, Skateboarding†, Snowboarding†, Wrestling†</td>
<td>Archery, Auto racing†, Diving†, Equestrian†, Motorcycling†</td>
</tr>
<tr>
<td></td>
<td>Body building†, Downhill skiing†, Skateboarding†, Snowboarding†, Wrestling†</td>
<td>Boxing†, Canoeing/Kayaking, Cycling†, Decathlon, Rowing, Speed-skating†, Triathlon†</td>
<td>American football*, Field events (jumping), Figure skating*, Rodeoing†, Rugby*, Running (sprint), Surfing†, Synchronized swimming†</td>
</tr>
<tr>
<td></td>
<td>Boxing†, Canoeing/Kayaking, Cycling†, Decathlon, Rowing, Speed-skating†, Triathlon†</td>
<td>Basketball*, Ice hockey*, Cross-country skiing (skating technique), Lacrosse*, Running (middle distance), Swimming, Team handball</td>
<td>Billiards, Bowling, Cricket, Curling, Golf, Riffery</td>
</tr>
<tr>
<td></td>
<td>Basketball*, Ice hockey*, Cross-country skiing (skating technique), Lacrosse*, Running (middle distance), Swimming, Team handball</td>
<td>Badminton, Cross-country skiing (classic technique), Field hockey*, Uniceuroming, Race walking, Racquetball/Squash, Running (long distance), Soccer*, Tennis</td>
<td>Baseball/Softball*, Fencing, Table tennis, Volleyball</td>
</tr>
</tbody>
</table>

**Increasing Dynamic Component**

<table>
<thead>
<tr>
<th>A. Low (&lt;40% Max O₂)</th>
<th>B. Moderate (40-70% Max O₂)</th>
<th>C. High (&gt;70% Max O₂)</th>
</tr>
</thead>
</table>

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GCVD

Long QT Syndrome  
Early Repolarisation / J point elevation  
Brugada Syndrome  
Wolf-Parkinson-White Syndrome  
Catecholaminergic Polymorphic VT  
Short QT Syndrome

2004 Guidelines

Recommendations for the Acceptability of Recreational (Non-competitive) Sports Activities and Exercise in Patients with GCVD*
GCVD and Exercise/Considerations

- Arrhythmogenicity of sports
- Burst exertion
- Auditory stimuli
- Swimming
- Diving
  - Restricted in all GCVD
- Greater risk of trauma in sports such as rock climbing, downhill skiing, ice hockey
- Increased stress/surges of emotion: roller coasters
- Paired athletic activities

Long QT

- Long QT patients with QTc greater than 0.48 s in males and 0.48 s in females are restricted from high intensity competitive sports
  - ESC 0.44 males and 0.46 females
- Genotype negative and phenotype positive are discouraged from participation in sports
  - ESC all gene positives excluded
- Genotype negative and borderline QTc are allowed to participate with close surveillance
Brugada syndrome

• Restricted from sports
  – No clear association between exercise and SCD in Brugada (potential impact of hyperthermia)
• Genotype positive and phenotype negative, no restriction
  – ESC: restricted

ARVD and CPVT

• CPVT
  – Restricted from sports
• ARVD
  – Restricted from sports
WPW

• EP study/ablation
  – Required in pts with impaired consciousness or persistent palpitations
  – Advisable in asymptomatic pts engaging in moderate or high level competitive sports
  – Asymptomatic athletes with WPW, EPS is not mandatory
    • ESC: mandatory
  – Return to sports: 4 wks/3 months post EPS

PVC’s

• No limitations in athletes without cardiac disease
• Low intensity sports in athletes where PVC’s increase with exercise
NSVT

• No restrictions, in Asymptomatic athletes without CHD, no NSVT > 10 beats, > 150/min and demonstrate suppression during exercise

HCM: Recommendations

• Excluded from all sports except low intensity sports such as golf
• HCM with low risk features
  – SCD of Cameroon soccer player Marc Vivien Foe
• Gene positive phenotype negative individuals
  – US/BC: not precluded from sports
  – ESC: restricted, based on regular exercise may play a role in triggering cellular mechanisms leading to HCM phenotype/cell death and myocardial fibrosis
TASK FORCE 2: Congenital Heart Disease

- Left-to-right shunting lesions: ASD, VSD, PDA
- Obstructive lesions: Pulmonary valve stenosis, Aortic valve stenosis, Coarctation of the aorta
- Cyanotic congenital cardiac disease – unoperated/operated
- Congenital coronary artery anomalies

Anomalous Coronary Arteries

Exclusion from all competitive sports
Participation 3 months after surgery after echo, max exercise testing
Atrial septal defect (ASD)

- small or large defect without pulmonary HTN
  – can participate in all competitive sports
- with pulmonary HTN – low intensity sports only (Class IA).
- with PVOD (pulmonary vascular obstructive disease). Cannot participate in competitive sports.

ASD: s/p closure

- 3-6 months after closure can fully participate in competitive sports if
  - No pulmonary hypertension
  - No arrhythmias
  - No evidence of myocardial dysfunction
VSD (ventricular septal defect)

- Small, restrictive defects – *can participate in all competitive sports*
- Large VSD – VSD closure recommended. If no pulm HTN – *low intensity sports only (IA)*
- 6 months post closure, *full participation if:*
  *No residual or small residual defect, no pulmonary HTN, no evidence of myocardial dysfunction.*
Pulmonary stenosis s/p intervention

If adequate relief and normal ventricular function.
• Balloon valvulolasty
  *resume full activity after 1 month*
• Surgical valvotomy
  *resume full activity after 3 months*

Mild aortic stenosis

Gradient ≤ 20 mmHg

*Can fully participate if normal ECG, normal exercise tolerance, asymptomatic (no history of exercise related chest pain, syncope, or arrhythmia)*
Moderate aortic stenosis

- Gradient 21-40 mmHG
- Mild LVH by echocardiography
- No LV strain on ECG
- Normal exercise test without ischemia or arrhythmia

*Low static/low to moderate dynamic (Class IA & IB)*

*Moderate static/low dynamic (Class IIA)*

Severe aortic stenosis

- Gradient $\geq$ 50 mmHg
- *NO COMPETITIVE SPORTS*
Sub AS and Supra Valvar AS

• Aortic stenosis Criteria also applies to discrete (membranous) subaortic stenosis and supravalvar stenosis

Coarctation - untreated

• Mild coarctation
  No severe collaterals vessels, no severe aortic root dilation, normal exercise test, small pressure gradients at rest, peak systolic BP <230 mmHg with exercise
  – Can fully participate in competitive sports

• More than mild (systolic arm to leg gradient >20 mmHg or peak systolic blood pressure >230 mmHg with exercise) – Low intensity sports (Class IA) only until treated.
Coarctation – post operative

- Participation in sports 6 months after treatment if systolic arm to leg gradient < 20 mmHg. Normal peak systolic BP at rest and with exercise. *NO high intensity static exercise (Class IIIA, IIIB, IIIC). No contact sports during first post-operative year.*
- After first year
  *All sports except power lifting if asymptomatic, normal BP at rest and exercise.*

Coarctation - untreated

- Mild coarctation – *Can fully participate in competitive sports*
  No severe collaterals vessels, no severe aortic root dilation, normal exercise test, small pressure gradients at rest, peak systolic BP <230 mmHg with exercise

- More than mild (systolic arm to leg gradient >20 mmHg or peak systolic blood pressure >230 mmHg with exercise) – *Low intensity sports (Class IA) only until treated.*
Cyanotic Heart disease - untreated

• Exercise intolerance and progressive hypoxemia with increasing effort
• *Low-intensity competitive sports (class IA)*

Cyanotic heart disease - palliated

• Arterial saturation above 80%
• No symptomatic arrhythmias
• No ventricular dysfunction
• Near-normal capacity by exercise testing

*Low intensity sports (Class IA)*
Tetralogy of Fallot- s/p repair

- Normal or near normal right heart pressure
- Only mild RV volume overload
- No residual left-to-right shunt
- No rhythm abnormality by Holter or exercise study

*Can participate in all competitive sports*

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Tetralogy of Fallot –s/p repair

- Residual RVH ≥ 50% systemic
- Severe pulmonary regurgitation
- Rhythm abnormality by Holter or exercise

*Low intensity sports (Class IA)*
TGA (Transposition of the great arteries) – s/p arterial switch

- Normal heart size
- No residual defects
- Normal ventricular function
- Normal exercise study
- No arrhythmias

*Can participate in all sports, however, high static sports with severe isometric effort (Class III A, IIIB, IIIC) should be discouraged.*

Marfan’s syndrome

- Low or moderate competitive sports in absence of
  - Aortic root < 4 cm/> 2SD from mean for BSA
  - Moderate MR
  - F/H of aortic dissection or SCD
- ESC
  - All phenotype or genotype positive are restricted
Conclusions

• Current guidelines possibly too restrictive
• Legal issues
• Individual exemptions may be made after detailed discussions and documentation
• Genotype positive phenotype negative cases will increasing need to be addressed
• AICD and sports