

THE HEART OF THE MATTER: CARDIOVASCULAR EMERGENCIES DURING COMPETITION

Central Connecticut State University
34th Sports Medicine Symposium
March 5, 2019

Bernard Clark, M.D., F.A.C.C.
Director, Non-Invasive Cardiology
Saint Francis Hospital and Medical Center
Professor of Medicine
University of Connecticut School of Medicine

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Case # 1

- 14 year old high school student playing goal in a lacrosse game was screened by an offensive player and was struck in the chest by the ball.
- He stumbled forward and collapsed face down, unconscious. His team mates surrounded him imploring him to breath and it was several minutes before CPR was begun and EMS called.
- His initial rhythm was ventricular fibrillation and he was defibrillated to a supraventricular rhythm and transferred to the local hospital ED.

Case # 1 (continued)

- ❑ He remained hemodynamically unstable overnight requiring pressor and ventilator support. Unfortunately, he never regained consciousness, was deemed to be brain dead and removed from life support the following day.
- ❑ Diagnosis: **Comotio cordis** secondary to being struck in chest by projectile

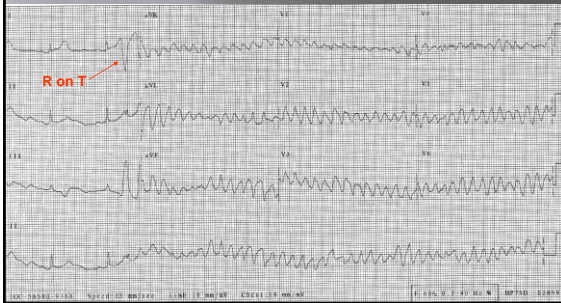
Comotio Cordis

- ❑ From Latin: "Agitation of the Heart"
- ❑ Impact of object on chest wall causes ventricular fibrillation and cardiac arrest
 - Hard, spherical objects most frequently:
 - Baseball
 - Softball
 - Lacrosse ball
 - Hockey puck
 - Much less frequently, soccer ball or fist
- ❑ Mortality rate very high, although more recent registry data demonstrates improvement to 58%

Comotio Cordis

- ❑ Most victims are young and male
 - Median age 15 in USA, 19 internationally
 - Related to exposure to "projectile" sports
 - Also due to increased flexibility of chest wall
 - Males may have increased predisposition to SCD
- ❑ Bad timing, bad location
 - Narrow electrical window (upslope of T wave)
 - Directly over the left ventricle
 - Compression of chest wall impinges on LV, suddenly increasing LV pressure (ST elevation)
 - In some respects, resemble VF during acute MI

"R on T" Phenomenon in Setting of Acute Myocardial Infarction



Comotio Cordis

- ❑ Object velocity important in precipitating VF
 - Likelihood of VF increases up to ~ 40 mph
 - Direct, rather than glancing blow required
- ❑ Commercially-available chest protectors are not effective (may not prevent compression of pliable chest wall)
- ❑ Immediate CPR and defibrillation are necessary to prevent death and permanent neurological damage

Case # 2

- ❑ 34 year old man, competitive cyclist, fell from his bicycle after passing out. No serious injury
- ❑ He had ascending a steep grade with maximal effort and stopped pedaling when he reached the summit. He immediately felt very lightheaded and did not remember falling to the ground.
- ❑ He admitted to having milder episodes of lightheadedness in the past following exertion.
- ❑ Physical exam, ECG, and echocardiogram normal.
- ❑ Had significant drop in systolic BP in early recovery on a treadmill exercise test.
- ❑ Diagnosis: **Post-Exertional Syncope**

Case # 3

- ❑ 27 year old woman referred to evaluate episodes of exertional pre-syncope and syncope
- ❑ She was a jogger who had noted episodes of lightheadedness while running and at times needed to sit or lie down to avoid passing out.
- ❑ Prior to referral, had frank syncope while walking on level ground.
- ❑ No associated nausea or other symptoms.

Case # 3 (continued)

- ❑ Physical examination unremarkable
- ❑ Transthoracic echocardiogram demonstrated asymmetrical septal hypertrophy (ASH) without evidence of outflow obstruction
- ❑ Treadmill exercise echo/Doppler stress test performed:
 - Drop in systolic blood pressure at peak exercise with onset of lightheadedness
 - No evidence of dynamic outflow obstruction
- ❑ Diagnosis: **Hypertrophic Cardiomyopathy (HCM)** with high-risk features
- ❑ Referred to HCM expert - ICD implantation

Case # 3 (continued)

Asymmetric Septal Hypertrophy



Syncope in the Athlete

- ▣ Syncope is a very common problem
 - Estimated lifetime prevalence ~ 40%
 - One screening survey in athletes documented syncope in 6.2% in the previous 5 years
- ▣ Should consider the episode of syncope in chronological context
 - Syncope unrelated to exercise
 - Post-exertional syncope
 - Syncope occurring during exercise

Syncope in the Athlete

- ▣ Syncope unrelated to exertion
 - ~ 85% of cases
 - Neurocardiogenic or vasovagal syncope
 - May be due to reduced venous return when standing
 - May be induced by noxious stimulus (sight of blood, unpleasant odor)
 - Sometimes caused by bearing down to pass stool or with micturition
 - Dehydration may cause orthostatic hypotension

Syncope in the Athlete

- ▣ Post-exertional syncope
 - Abrupt termination of exercise leads to reduced venous return from lower extremities
 - Reduced venous return will reduce RV and LV filling ⇒ enhanced adrenergic tone
 - Increased contractility may cause the Bezold-Jarisch reflex (vagal)
 - Decreased vascular tone and inappropriate bradycardia ⇒ hypotension, decreased cerebral perfusion and syncope
 - Potentiated by dehydration/reduced plasma volume

Syncopal in the Athlete

- ▣ Syncopal during exercise – cause for concern
 - May indicate presence of structural heart disease
 - Hypertrophic cardiomyopathy
 - Anomalous coronary artery origin
 - Arrhythmogenic right ventricular dysplasia (ARVD)
 - Cardiomyopathy (non-compaction, infiltrative)
 - Myocarditis
 - Presence of bypass tract (Wolff-Parkinson-White)
 - May indicate presence of ion channelopathy
 - Brugada syndrome
 - Long QT syndrome (LQTS)

Syncopal in the Athlete

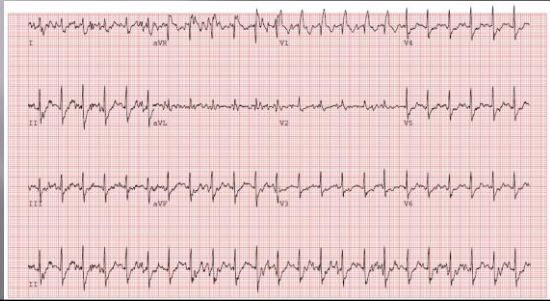
- ▣ All patients merit a careful evaluation
 - Detailed history from athlete and witnesses to the syncopal event (including family Hx)
 - Prodromal symptoms (lightheadedness/chest pain)
 - Duration of syncopal, presence of seizure activity
 - Thorough physical exam
 - ECG (LVH, ST-T wave changes, evidence of channelopathy or bypass tract)
 - Echocardiogram
 - Rhythm monitor (24 Holter or continuous loop)
 - Exercise test to reproduce condition leading to syncopal
 - Possibly cardiac CT scan or MRI

Case # 4

- ▣ 45 year old active man has been noting mild lightheadedness, sense of racing heartbeat, and chest tightness while running
- ▣ Cardiopulmonary exam normal except for widely split S2
- ▣ Has chronic RBBB on ECG
- ▣ 24 hour Holter monitor recording demonstrated some isolated ventricular premature beat
- ▣ Referred for stress echocardiogram

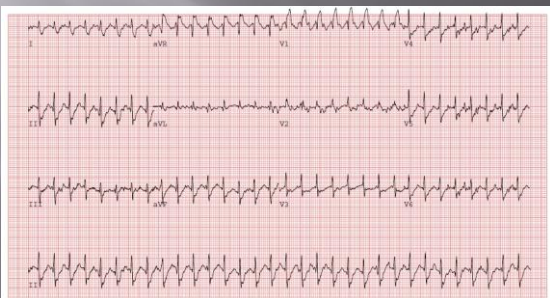
Case # 4 (continued)

- Approaching peak exercise



Case # 4 (continued)

- At peak exercise (mildly lightheaded)



Case # 4 (continued)

- He developed lightheadedness similar to prior episodes
- The narrow-complex tachycardia spontaneously terminated with resumption of sinus rhythm in the 1st minute of recovery.
- Diagnosis: **Probable atrioventricular node re-entry tachycardia (PSVT)**
- Placed on low-dose beta blocker

Supraventricular Tachycardia

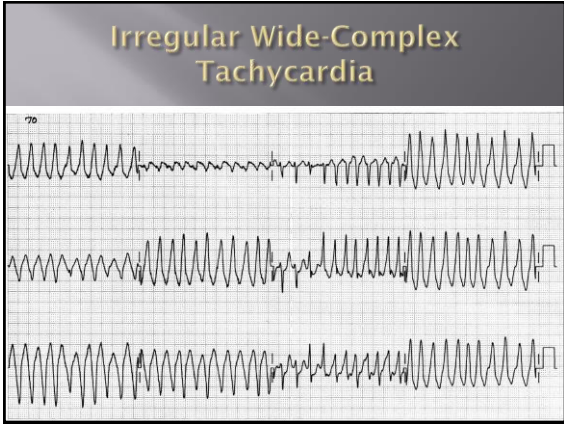
- A variety of rhythms possible
 - Atrial fibrillation is the most common arrhythmia in athletes
 - Association with endurance running
 - May be secondary to left atrial enlargement
 - Atrial flutter may occur with right atrial enlargement
 - Atrioventricular node re-entrant tachycardia (AVNRT)
 - Atrioventricular reciprocating tachycardia (AVRT) due to bypass tracts (W-P-W)
 - Automatic atrial tachycardia

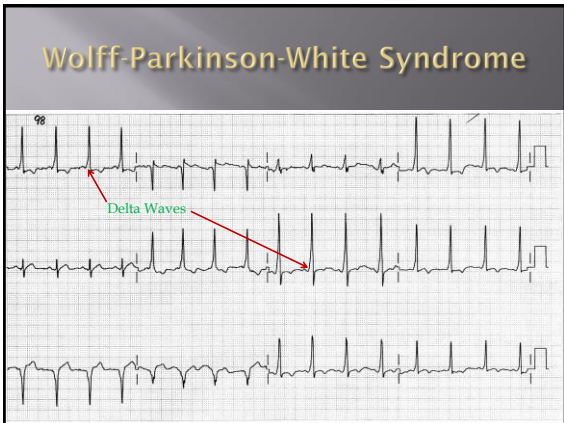
Supraventricular Tachycardia

- Common symptoms
 - Abrupt onset when arrhythmia occurs
 - Palpitations – awareness of rapid heart rate
 - Breathlessness
 - Chest tightness
 - Lightheadedness
- Arrhythmia may terminate spontaneously
 - Sinus rhythm likely present by the time ECG obtained
 - May require long-term monitoring to ID the rhythm
 - Re-entrant rhythms (AVNRT or AVRT) may terminate with Valsalva or carotid sinus massage

Supraventricular Tachycardia

- Medications may prevent re-entrant rhythms or slow AV node conduction of atrial fibrillation/atrial flutter
 - Beta blockers
 - Calcium channel blockers
- Radiofrequency ablation may be necessary eliminate the re-entrant pathway
 - If W-P-W is present, concern about possible dangerously rapid rhythm if atrial fibrillation occurs





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