**CORD Sports Medicine Toolkit: Collapse During Exercise**

**Summary Handout**

Background

As an Emergency Physician, you will see patients who collapse during athletic activity, both when working and when off-duty, in and out of the hospital. Understanding the differential diagnosis, historical features, and clinical presentations of patients experiencing different causes is important for identifying life threats and initiating appropriate workup and treatment.

Differential diagnosis for collapse during exercise

Exercise-associated collapse

Sickle cell trait-associated collapse

Temperature-related illness

Volume depletion

Sodium metabolism

Cardiac pathology

-structural

-electrophysiologic

Ischemic cardiac disease

-most common etiology for athletes >35 years old

Exercise-associated collapse

* most common reason athletes are treated in medical tent following endurance event
* loss of muscle pumping action + cutaneous vasodilation = postural hypotension
* usually occurs **after** an athlete crosses the finish line
* patient is generally awake and breathing (rarely loss of consciousness)

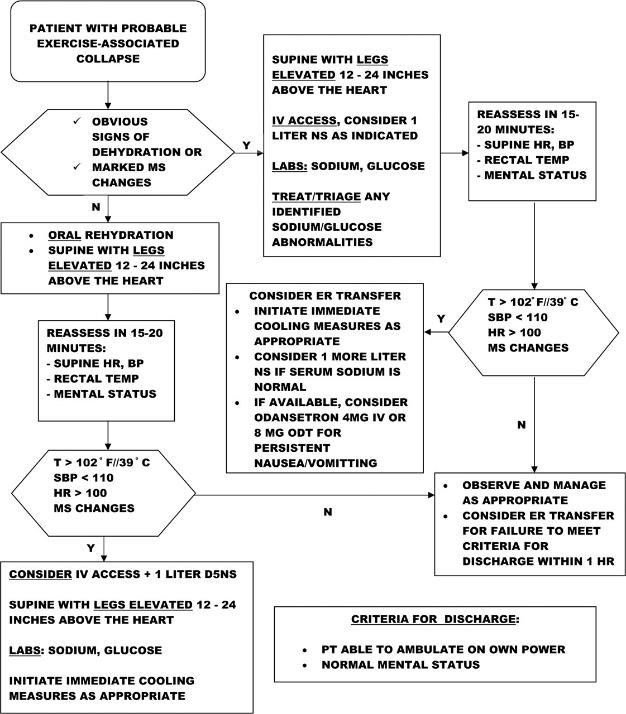


Figure 1. Exertional collapse algorithm.

Asplund CA, O'Connor FG, Noakes TD. Exercise-associated collapse: an evidence-based review and primer for clinicians. *British Journal of Sports Medicine*2011;**45:**1157-1162.

Sickle cell trait-associated collapse

* increased risk of collapse during vigorous exercise related to sickling
* predisposes athletes to rhabdomyolysis and hyperkalemia resulting in collapse or death
  + hypoxia, dehydration, lactic acidosis, hyperthermia can all precipitate sickling

ECG interpretation in athletes

Normal changes in trained hearts

* sinus arrhythmia
* sinus bradycardia
* isolated left ventricular hypertrophy
* incomplete right bundle branch block
* 1st degree AV block or Mobitz 1 (Wenckebach)
* junctional rhythms (sinus rate is slower than junctional escape rate)
* early repolarization
* ST elevation V1-V3 in Afro-Caribbean athletes

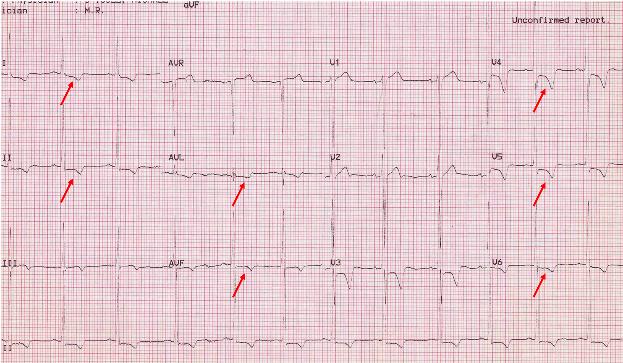
[Distinguish it from Brugada syndrome: Zorzi A, et al. Differential diagnosis between early repolarization of athlete's heart and coved-type Brugada electrocardiogram. *Am J Cardiol* 2015;115:529-532.]

Cardiac conditions predisposing athletes to sudden cardiac death – structural

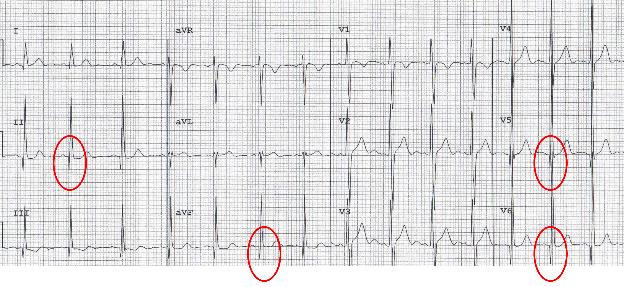
* hypertrophic cardiomyopathy (HCM)
  + asymmetric ventricular or septal wall hypertrophy 🡪
    - obstruction of flow from the left ventricle
    - impaired cardiac filling in diastole
    - increased risk for cardiac dysrhythmias including ventricular fibrillation
  + frequently genetic, accentuated by the hyperplastic effects of training
  + EKG findings
    - T wave inversion
    - ST segment depression
    - pathologic Q waves
    - conduction delay
    - left axis deviation
    - left atrial enlargement



T wave inversions



ST depression and T wave inversions

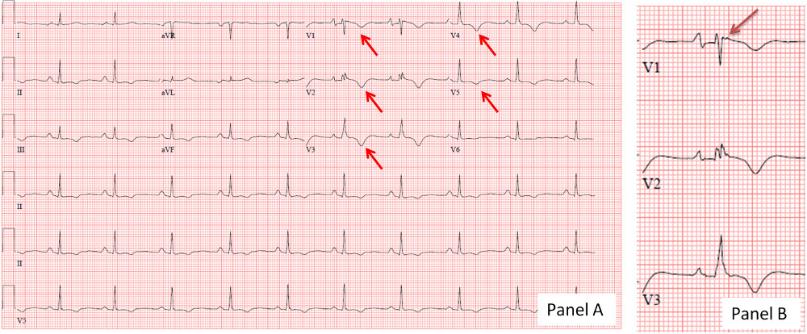


Pathologic Q waves – “dagger-like”

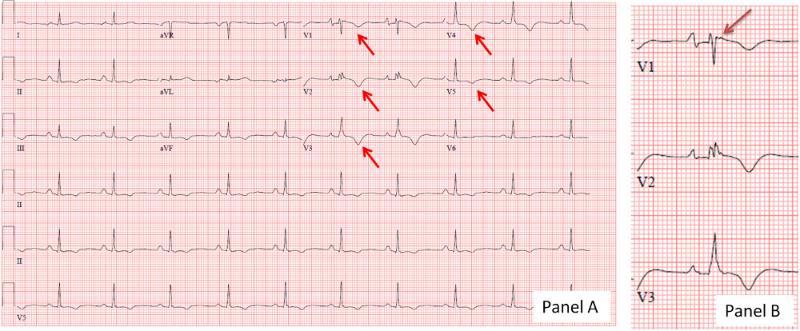


Left axis deviation

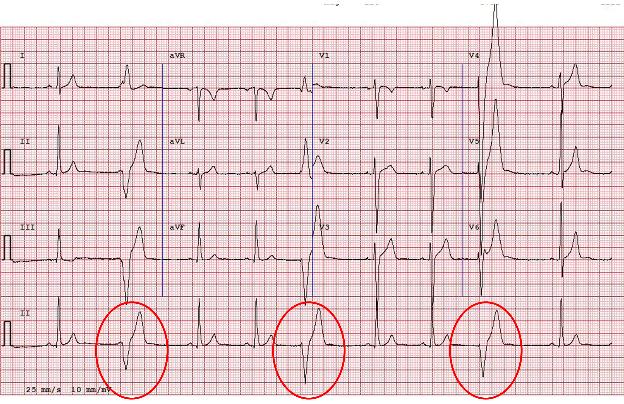
* arrhythmogenic right ventricular dysplasia (ARVD)
  + fibro-fatty replacement of right ventricular myocardium 🡪
    - life threatening ventricular arrhythmias or sudden cardiac death
  + progressive dilation and dysfunction predominantly involve the right ventricle
    - involvement of the left ventricle in late-stage disease
  + EKG Findings
    - inverted T waves



Inverted T waves



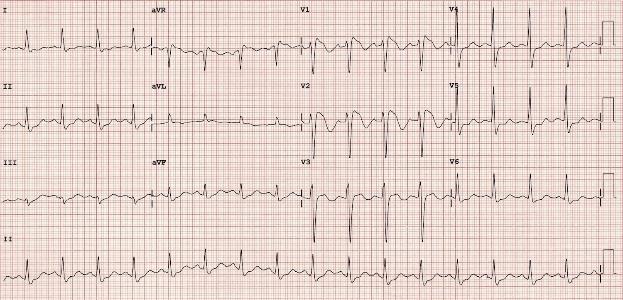
Epsilon waves



Negative LBBB in limb leads – concern for right ventricular wall pathology

Cardiac conditions predisposing athletes to sudden cardiac death - electrical

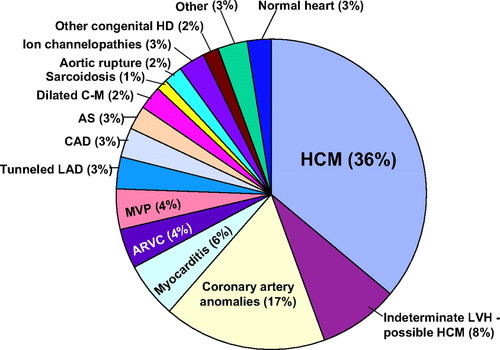
* long QT
* short QT
* Brugada syndrome
  + “high take off“ ST segment elevation in the right precordial leads
  + predisposes to ventricular fibrillation and sudden death in the absence of clinically demonstrable structural heart disease



High take off ST elevations in precordial leads

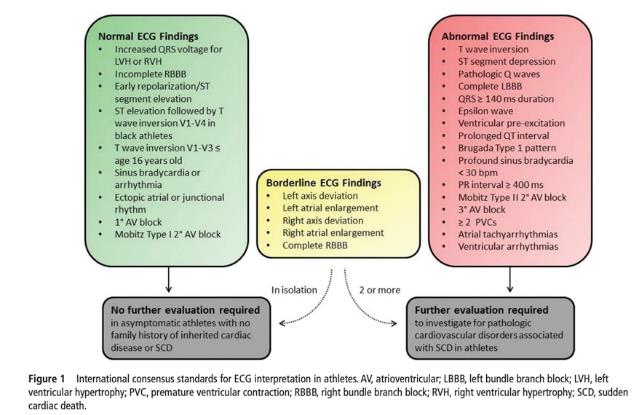
* catecholaminergic polymorphic ventricular tachycardia
  + inherited arrhythmogenic disorder
  + ventricular ectopy induced by exercise or emotional stress
  + resting EKG is normal
  + Exercise stress test is diagnostic
* Wolff-Parkinson-White Syndrome
  + short PR interval (<120 ms)
  + delta wave (slurring of the initial QRS)
  + wide QRS (> 120 ms)
  + predisposes to tachydysrhythmia and sudden cardiac death
* supraventricular tachycardia (SVT)
  + atrioventricular reentrant tachycardia (AVRT)
    - accessory atrioventricular bypass pathway
      * orthodromic: the circuit typically conducts down the AV node and up the bypass pathway 🡪 narrow complex tachycardia
      * antidromic: electrical circuit conducts down the accessory pathway and up the AV node 🡪 wide complex tachycardia
  + atrioventricular nodal reentrant tachycardia (AVNRT)
    - circuit involving a slow and fast pathway entering & exiting the AV node
    - most common SVT

Etiologies of sudden cardiac death in US athletes



Barry J. Maron. Circulation. Recommendations and Considerations Related to Preparticipation Screening for Cardiovascular Abnormalities in Competitive Athletes: 2007 Update, Volume: 115, Issue: 12, Pages: 1643-1655, DOI: (10.1161/CIRCULATIONAHA.107.181423)

Algorithm for interpreting EKGs in athletes



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* International criteria for electrocardiographic interpretation in athletes: consensus statement [https://bjsm.bmj.com/content/bjsports/51/9/704.full.pdf]
* LITFL athlete EKGs [https://litfl.com/tag/athlete/]
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