

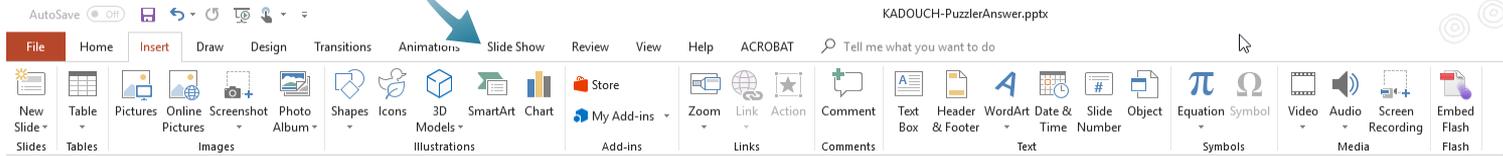
December 2018

# ECG Underwriting Puzzler

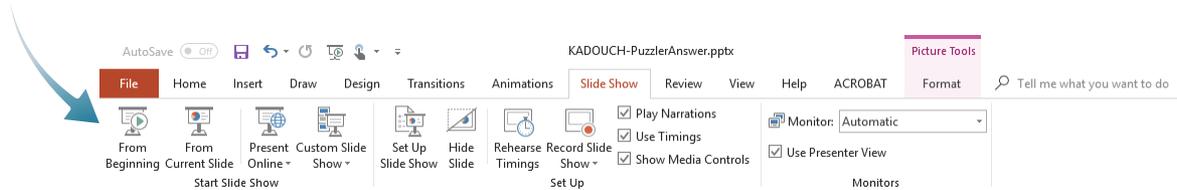
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AVP & Medical Director

# To obtain best results...

- Select “Slide Show” from the ribbon at the top of your PowerPoint screen



- Select “From Beginning” on the Slide Show screen



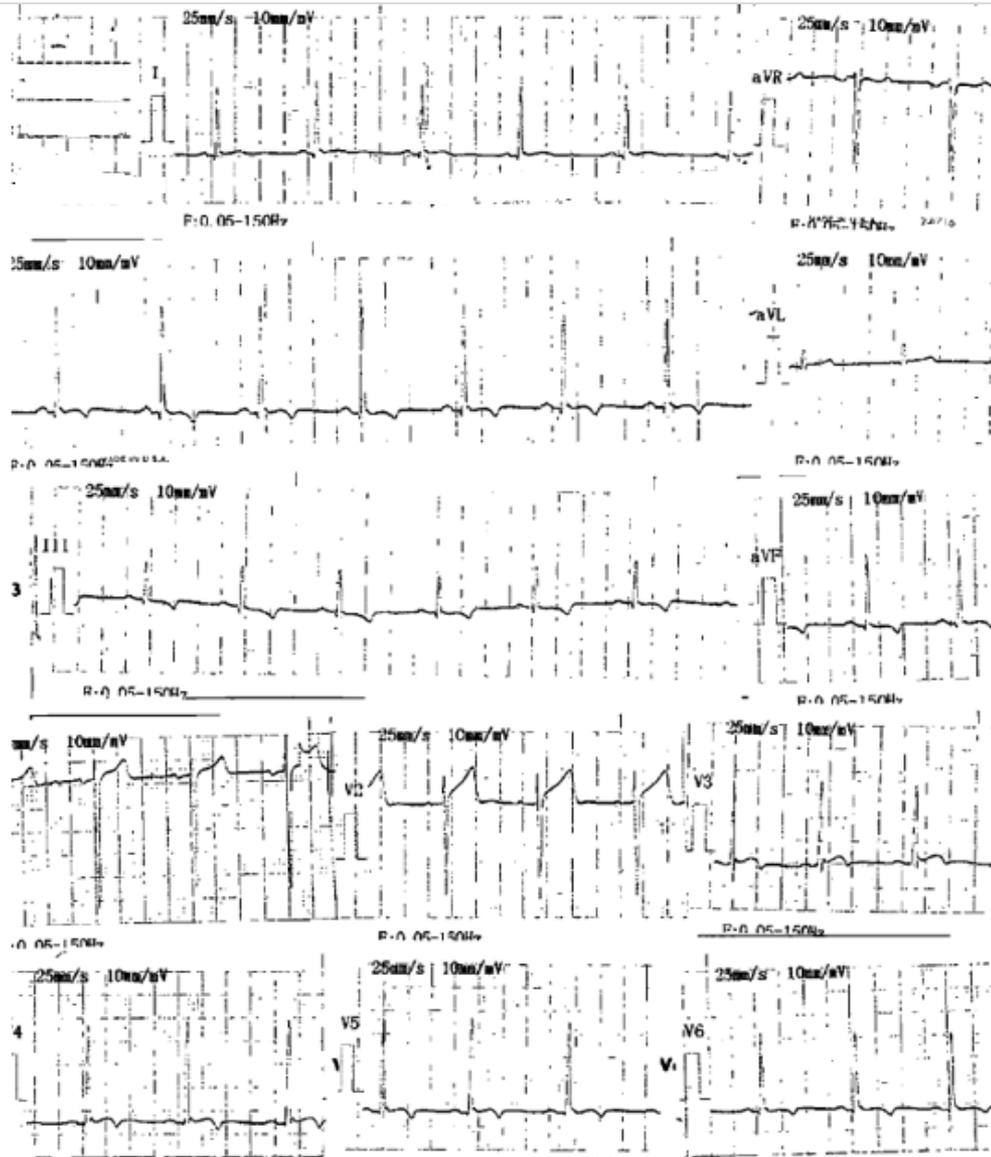
- Slowly click through the presentation
- Enjoy the animation

# The Case

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- A 23-year-old professional athlete applies for \$3,000,000 of life insurance.
- BMI 38, BP, lipids and LFTs are normal.
- No declared family history.
- An EKG was provided.

# The Insurance EKG



# EKG abnormalities in the athlete

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**EKG changes in athletes are common and usually reflect functional remodeling of the heart as an adaptation to intense regular physical training (athlete's heart).**



**Rarely, abnormalities of an athlete's EKG may be an expression of underlying heart disease that may have risk of sudden arrhythmic death.**



**It is necessary to distinguish between the EKG abnormalities from intensive physical training and those potentially associated with increased cardiovascular risk.**

# Evolution of EKG criteria in athletes

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**2010 ESC (European Society of Cardiology) criteria**



**2011 Stanford criteria**



**2012 Seattle criteria**



**2014 Refined criteria**



**2015 International criteria**

# Normal EKG findings in the athlete, international recommendations

- ⇒ Sinus bradycardia  $\geq 30$  bpm
- ⇒ Sinus arrhythmia
- ⇒ Ectopic atrial rhythm
- ⇒ Junctional escape rhythm
- ⇒ 1<sup>st</sup> degree AV block PR interval 200-400ms
- ⇒ Mobitz Type I (Wenckebach) 2° AV block
- ⇒ Incomplete RBBB rSR' pattern in V1 and qRS in V6 with QRS duration  $< 120$ .
- ⇒ Increased QRS voltage Isolated QRS voltage criteria for left or right ventricular hypertrophy
- ⇒ Juvenile T wave pattern T wave inversion V1-V3 in athletes  $< \text{age } 16$
- ⇒ Early repolarization (ST elevation, J-point elevation, J-waves, or terminal QRS slurring in the inferior and/or lateral leads)
- ⇒ Convex domed ST segment elevation combined with T wave inversion in V1-V4 in black/African athletes.

# Borderline EKG findings in the athlete, international recommendations

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**Left axis deviation**  $-30^{\circ}$  to  $-90^{\circ}$



**Left atrial enlargement** P wave duration of  $>120\text{ms}$  in leads I or II with negative portion of the P wave  $\geq 1\text{ mm}$  in depth and  $\geq 40\text{ms}$  in duration in V1



**Right axis deviation**  $> 120^{\circ}$



**Right atrial enlargement** P wave  $\geq 2.5\text{mm}$  in II, III, or aVF



**Complete RBBB** rSR' pattern in V1 and an S wave wider than R wave in V6 with QRS duration  $\geq 120\text{ms}$

# Abnormal EKG findings in the athlete

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- **T wave inversion**
- **ST segment depression**
- **Pathologic Q waves**
- **LBBB**
- **Profound nonspecific Intraventricular conduction delay  $\geq 140\text{ms}$**
- **Epsilon wave**
- **Ventricular pre-excitation PR interval  $< 120\text{ms}$  with a delta wave and wide QRS**
- **Prolonged QT interval**
- **Brugada Type 1 pattern**
- **Profound sinus bradycardia**
- **Profound 1° AV block**
- **Mobitz Type II 2° AV block**
- **3° AV block**
- **Atrial tachyarrhythmias**
- **Premature ventricular contractions  $\geq 2$  PVCs per 10 s tracing**
- **Ventricular arrhythmias**

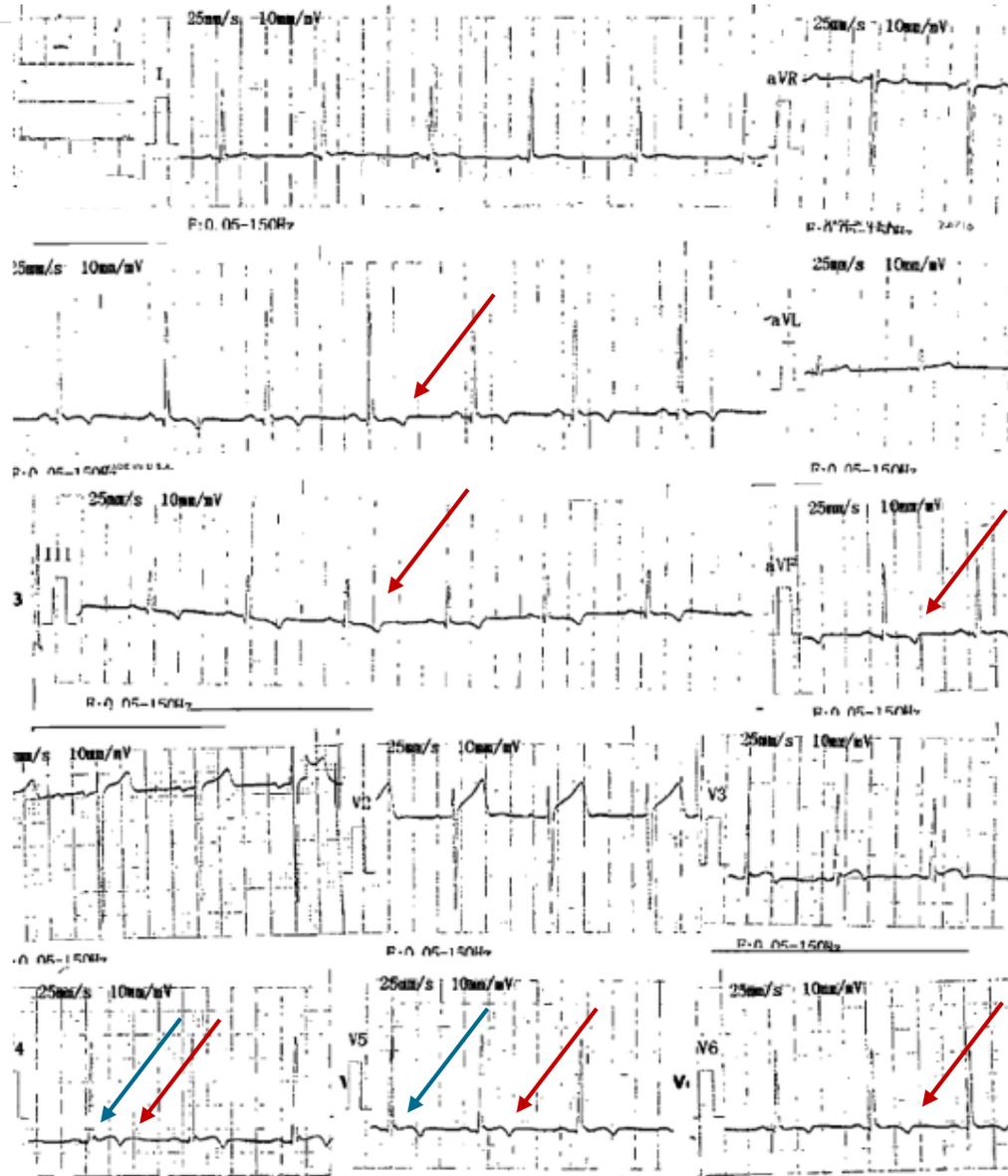
# Back to the case...

Normal sinus rhythm

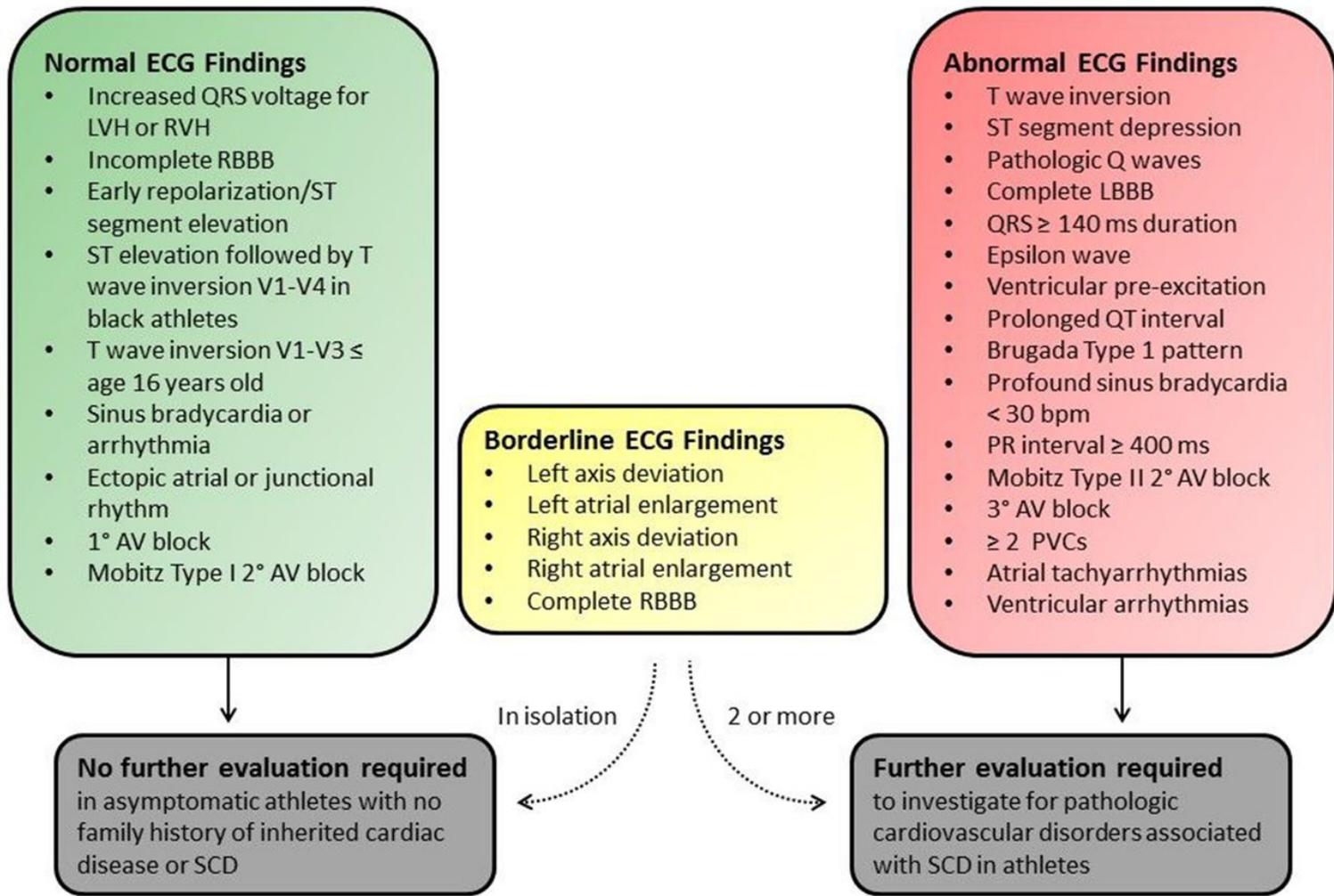
Early repolarization

Left ventricular hypertrophy by voltage criteria

But... there are also inverted T waves in 2, 3, aVF, V4-V6



**International consensus standards for ECG interpretation in athletes. AV, atrioventricular; LBBB, left bundle branch block; LVH, left ventricular hypertrophy; PVC, premature ventricular contraction; RBBB, right bundle branch block; RVH, right ventricular hypertrophy; SCD, sudden**



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# Conclusion

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- Early repolarization is consistent with an athlete's heart. Early repolarization has several different forms, and itself may pose additional risk, but we will not address that in this article.
- LVH would be consistent with an athlete's heart except for the fact that there are also inverted T waves present.
- Inverted T waves in 2, 3, aVF and V4-V6 need to be evaluated. Potential cardiac diseases include hypertrophic cardiomyopathy, dilated cardiomyopathy, left ventricular noncompaction, arrhythmogenic right ventricular cardiomyopathy, and myocarditis. A cardiac evaluation consisting of an ECHO, a stress test, a 24 EKG monitor, and possibly a cardiac MR would be necessary to properly evaluate this PI.
- This case was postponed for further evaluation.