

**ETHNIC DIFFERENCES IN  
REPOLARISATION PATTERNS  
IN ELITE MALE ATHLETES AND  
CLINICAL OUTCOMES**

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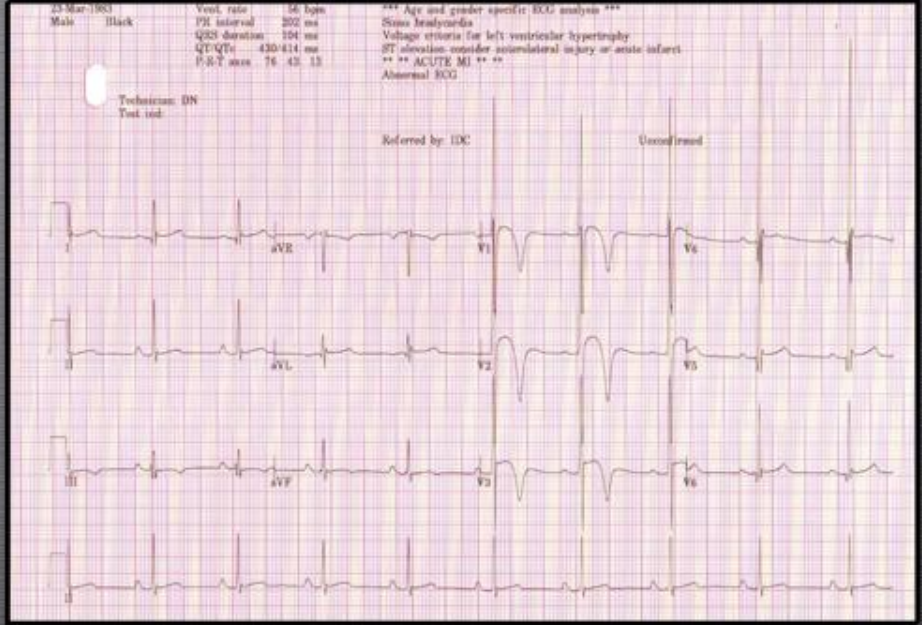
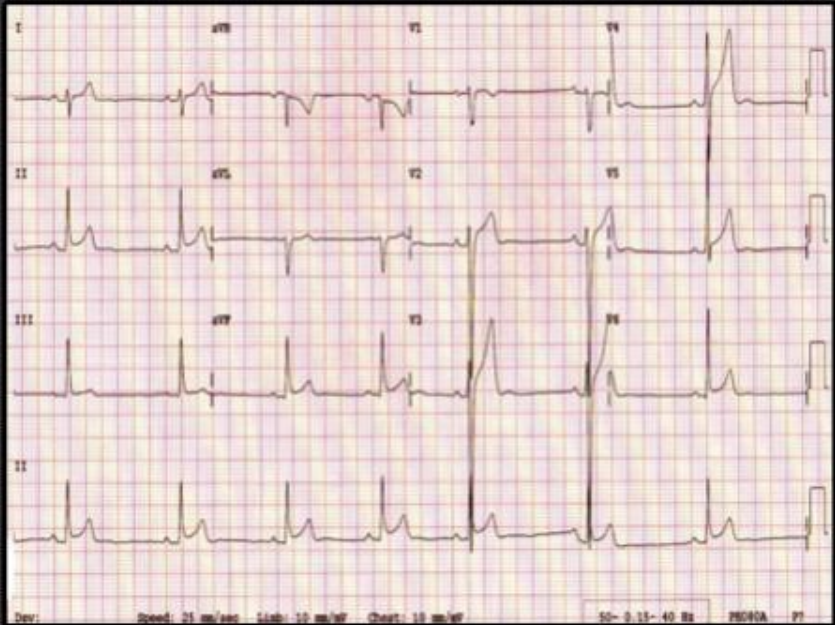
**UNIVERSITY HOSPITAL LEWISHAM, LONDON, UK**

# ETHNICITY AND CARDIOVASCULAR ADAPTATION TO EXERCISE

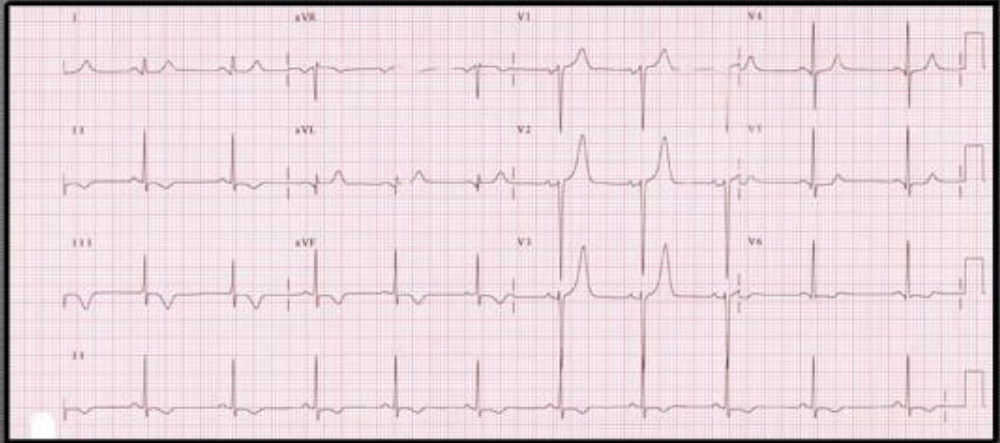
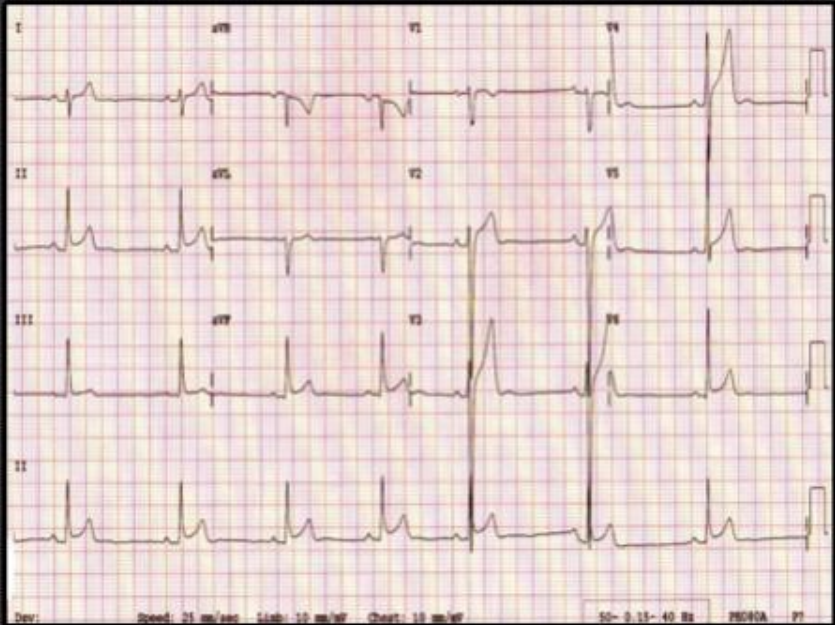
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- Most studies in Caucasian athletes
- Racial factors are an important determinant
- Black athletes develop
  - Greater degree of LVH
  - Marked repolarisation changes on the ECG

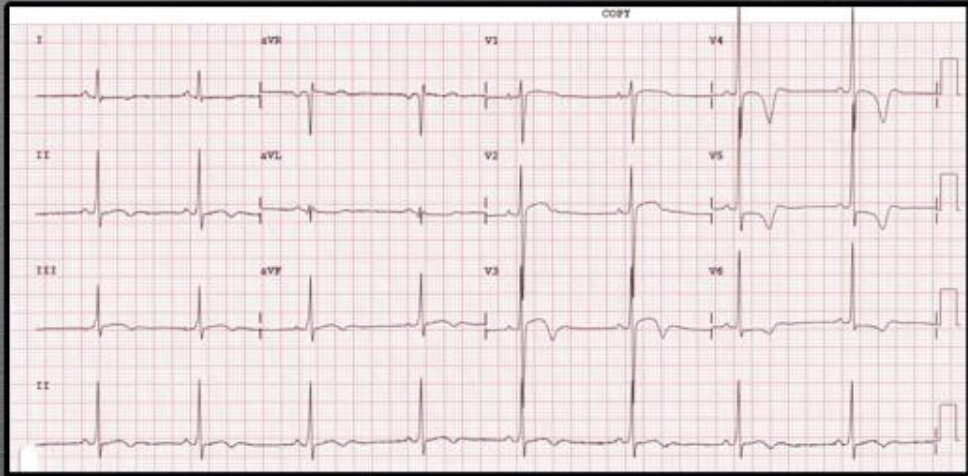
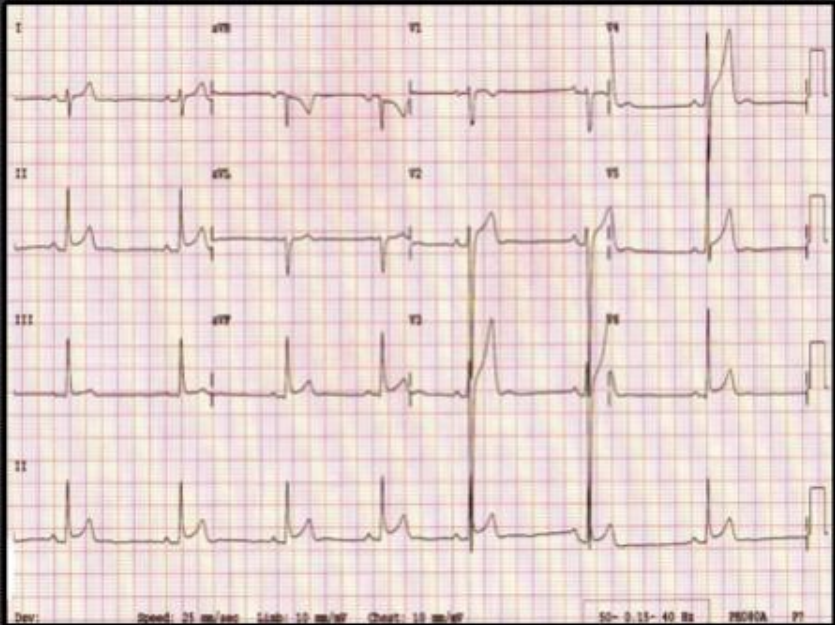
# ECG REPOLARISATION CHANGES IN ATHLETE'S



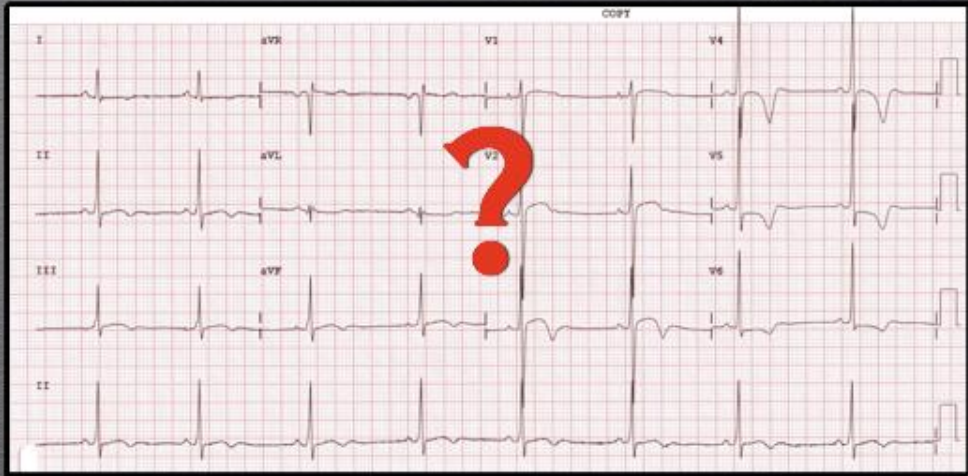
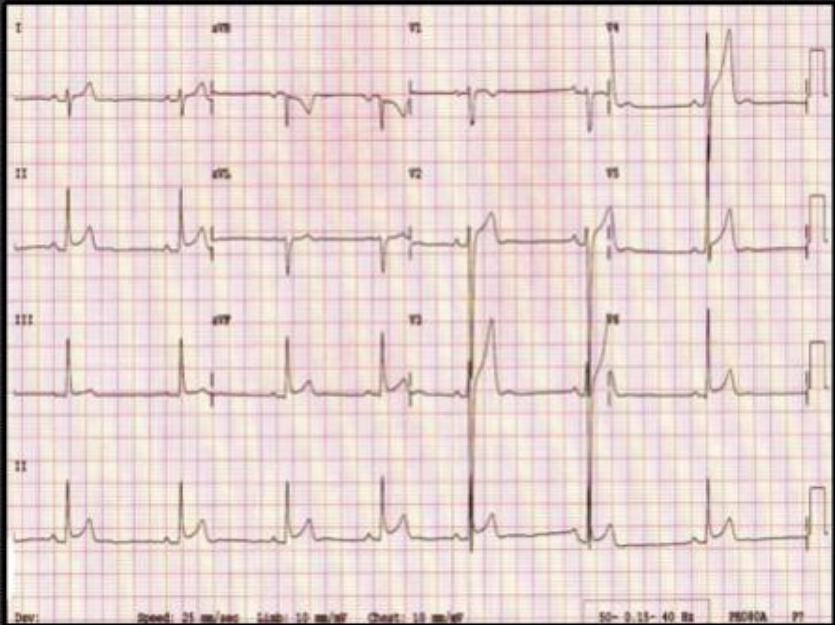
# ECG REPOLARISATION CHANGES IN ATHLETE'S



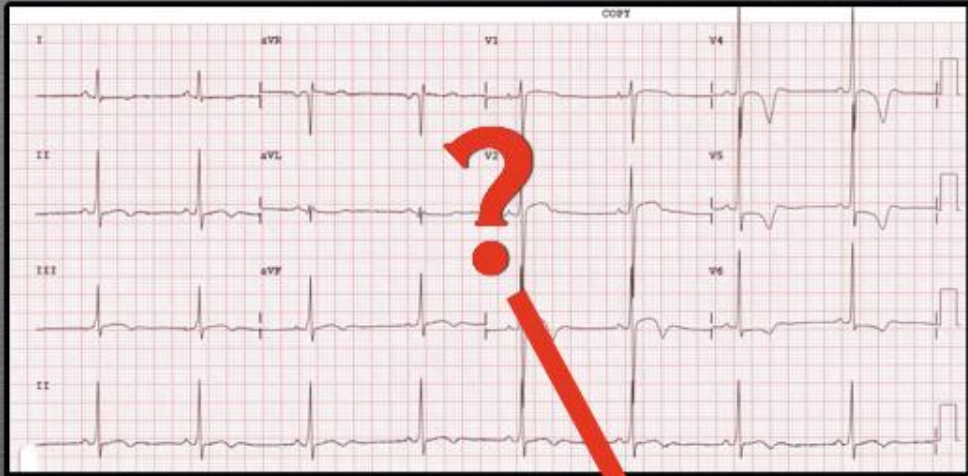
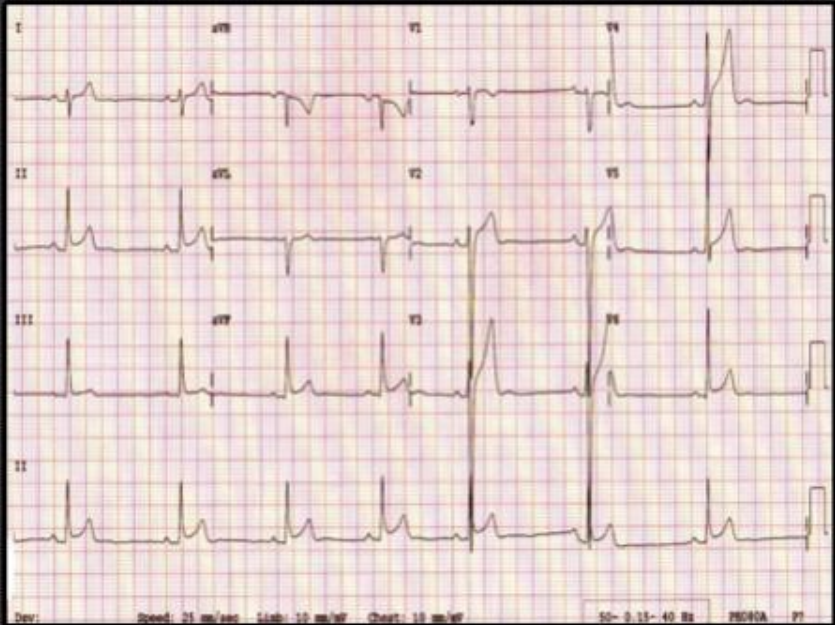
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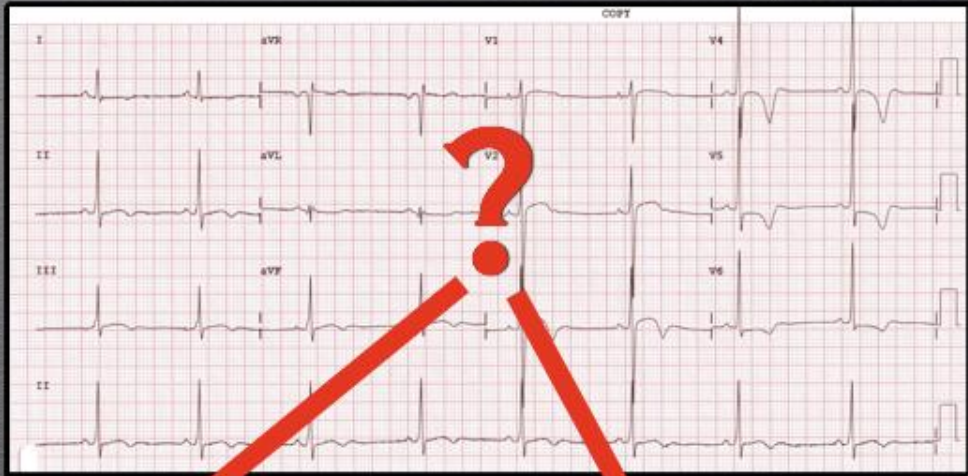
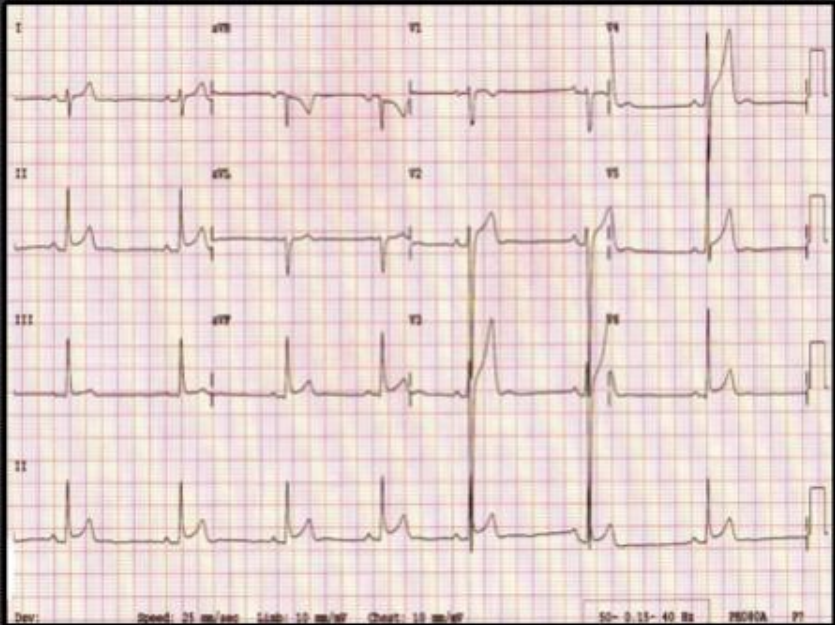
# ECG REPOLARISATION CHANGES IN ATHLETE'S



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# BLACK ATHLETE'S HEART OR HCM ?

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- HCM is the most prevalent cause of SCD in athletes
- Black athletes more susceptible to SCD from HCM
- Black athletes comprise a significant proportion of elite athletes
- Pre-participation cardiac screening

# OBJECTIVE OF THE STUDY

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- Evaluate the prevalence and significance of ECG repolarisation anomalies in black athletes
- Differentiate between
  - physiological adaptation to exercise
  - ECG patterns suggestive of HCM

# METHODOLOGY

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- Collaborative research program btw UK & France
- Between 1996 and 2010
  - 904 normotensive black athletes were evaluated with
    - history
    - targeted cardiovascular examination
    - 12-lead ECG
    - ECHO
    - +/- Further investigations as necessary
- 1819 white athletes, 119 black controls, 155 HCM patients

# DEFINITIONS

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- Athlete: Competing on a regular basis at International, National or Regional level
- Control: Sedentary individuals,  $\leq 2$  hours / week
- T-wave  $\downarrow$ : in  $\geq 2$  leads, excluding  
AVR, V1 + III, V1 + AVL + inferior axis
- ST-segment  $\uparrow$ :  $\geq 0.1$  mV in  $\geq 2$  contiguous leads
- ST-segment  $\downarrow$ :  $\geq -0.1$  mV in  $\geq 2$  contiguous leads

# RESULTS

## **BLACK ATHLETES VS. WHITE ATHLETES** **DEMOGRAPHICS**

|                            | <b>Black Athletes<br/>n=904</b> | <b>White Athletes<br/>n=1819</b> | <b>p-value</b> |
|----------------------------|---------------------------------|----------------------------------|----------------|
| <b>Age (years)</b>         | 22.5 ± 5.0                      | 17.4 ± 4.1                       | <0.001         |
| <b>BSA (m<sup>2</sup>)</b> | 1.92 ± 0.20                     | 1.87 ± 0.24                      | <0.001         |
| <b>Hours exercise/week</b> | 15.2 ± 6.1                      | 13.1 ± 6.2                       | <0.001         |
| <b>Systolic BP (mmHg)</b>  | 116.5 ± 10.9                    | 111.8 ± 11.0                     | <0.001         |

# BLACK ATHLETES VS. WHITE ATHLETES

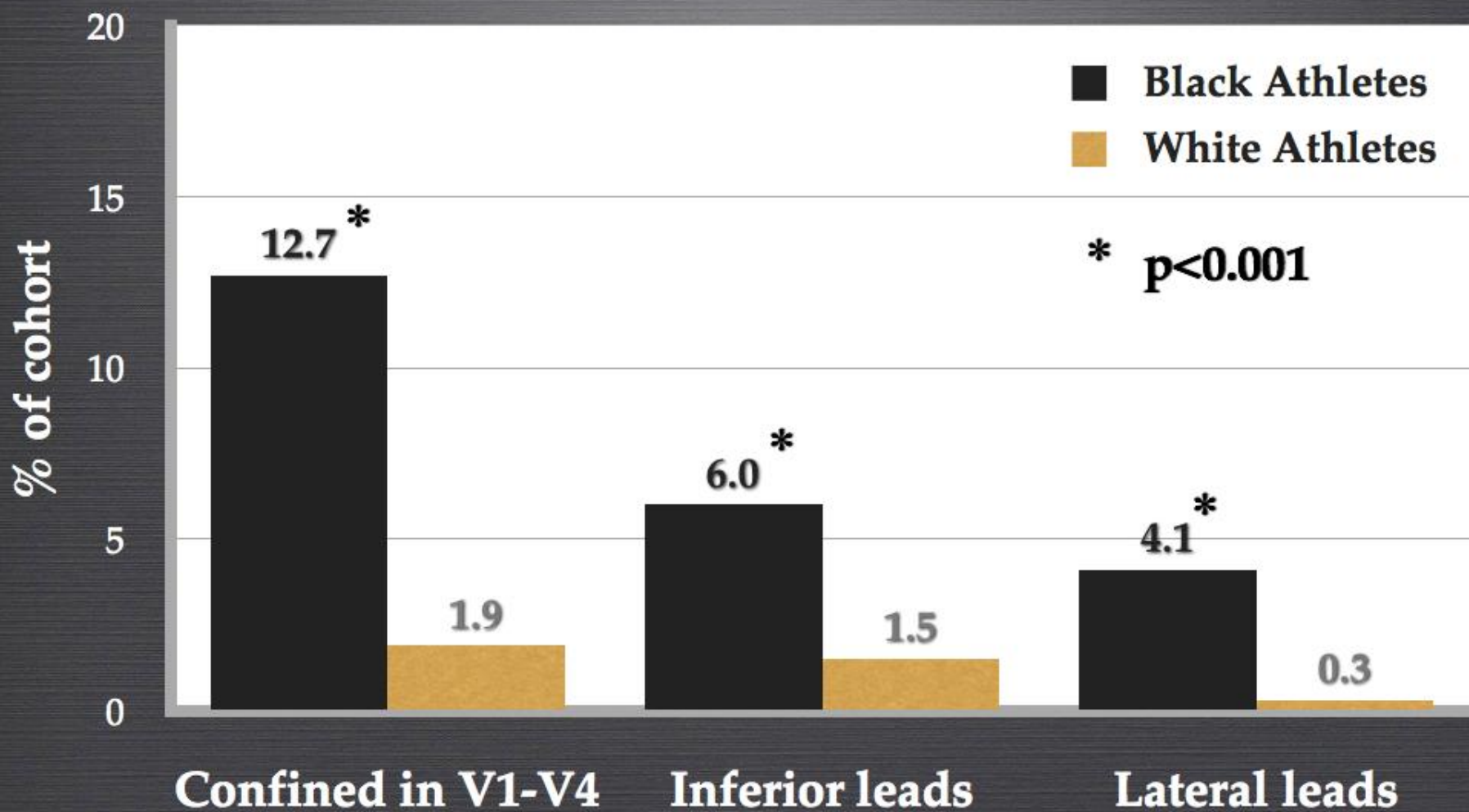
## ECHOCARDIOGRAPHIC PARAMETERS

|                | Black Athletes<br>n=904 | White Athletes<br>n=1819 | p-value |
|----------------|-------------------------|--------------------------|---------|
| LA (mm)        | 35.40 ± 4.48            | 34.74 ± 4.68             | 0.028   |
| LVED (mm)      | 52.64 ± 4.42            | 52.55 ± 4.25             | 0.576   |
| max-LVWTd (mm) | 10.61 ± 1.61            | 10.00 ± 1.21             | <0.001  |
| LVM (g)        | 203.43 ± 50.63          | 188.33 ± 44.13           | <0.001  |
| E/A ratio      | 2.09 ± 0.85             | 2.19 ± 0.76              | 0.001   |

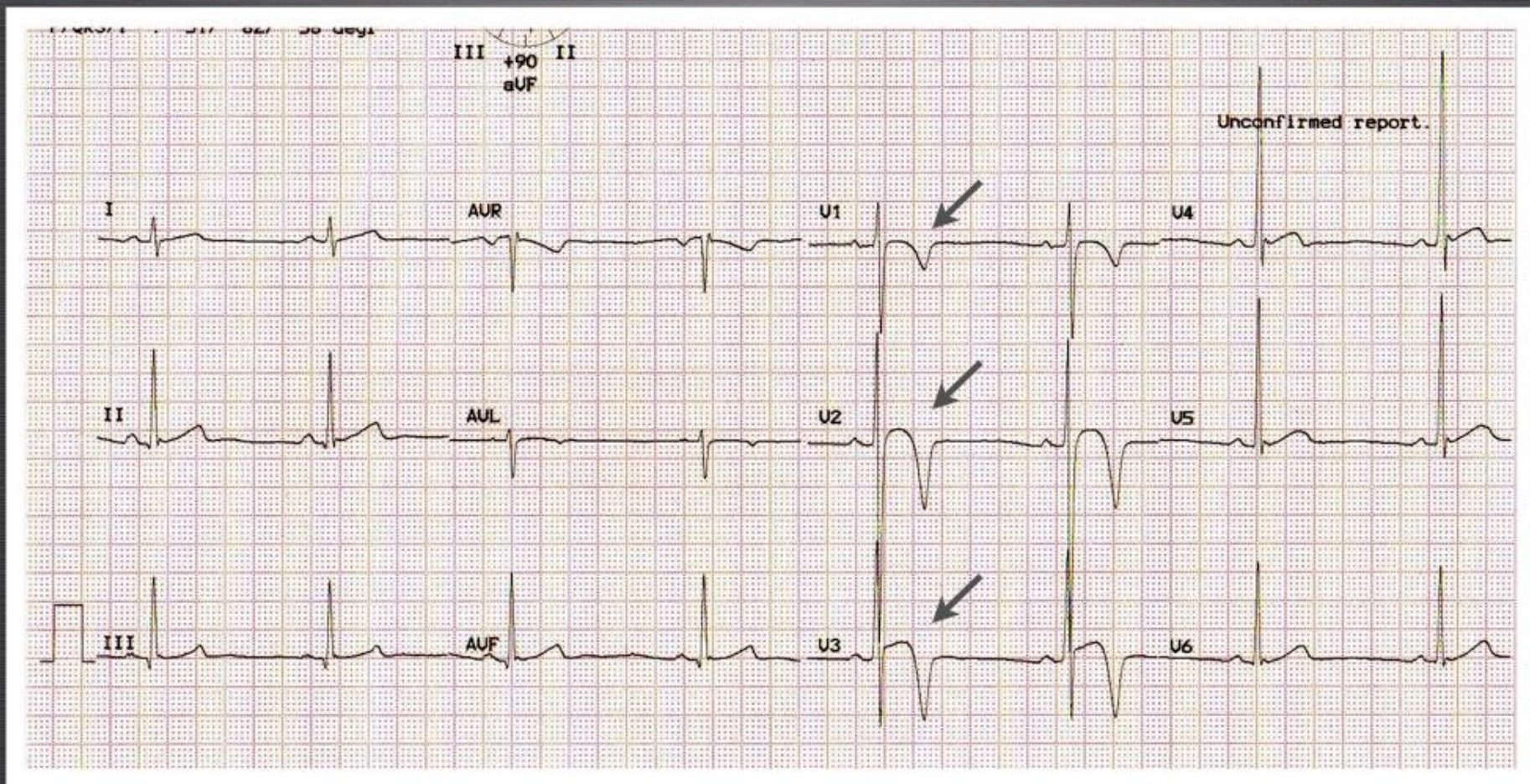
# ECG REPOLARISATION CHANGES BLACK ATHLETES VS. WHITE ATHLETES

|                      | <b>Black Athletes<br/>n=904</b> | <b>White Athletes<br/>n=1819</b> | <b>p-value</b> |
|----------------------|---------------------------------|----------------------------------|----------------|
| <b>T-wave ↓</b>      | 22.8%                           | 3.7%                             | <0.001         |
| <b>Deep T-wave ↓</b> | 12.1%                           | 1%                               | <0.001         |
| <b>ST-segment ↑</b>  | 63.2%                           | 26.5%                            | <0.001         |
| <b>ST-segment ↓</b>  | 0.4%                            | 0                                | 0.012          |

# DISTRIBUTION OF T-WAVE ↓ BLACK ATHLETES VS. WHITE ATHLETES



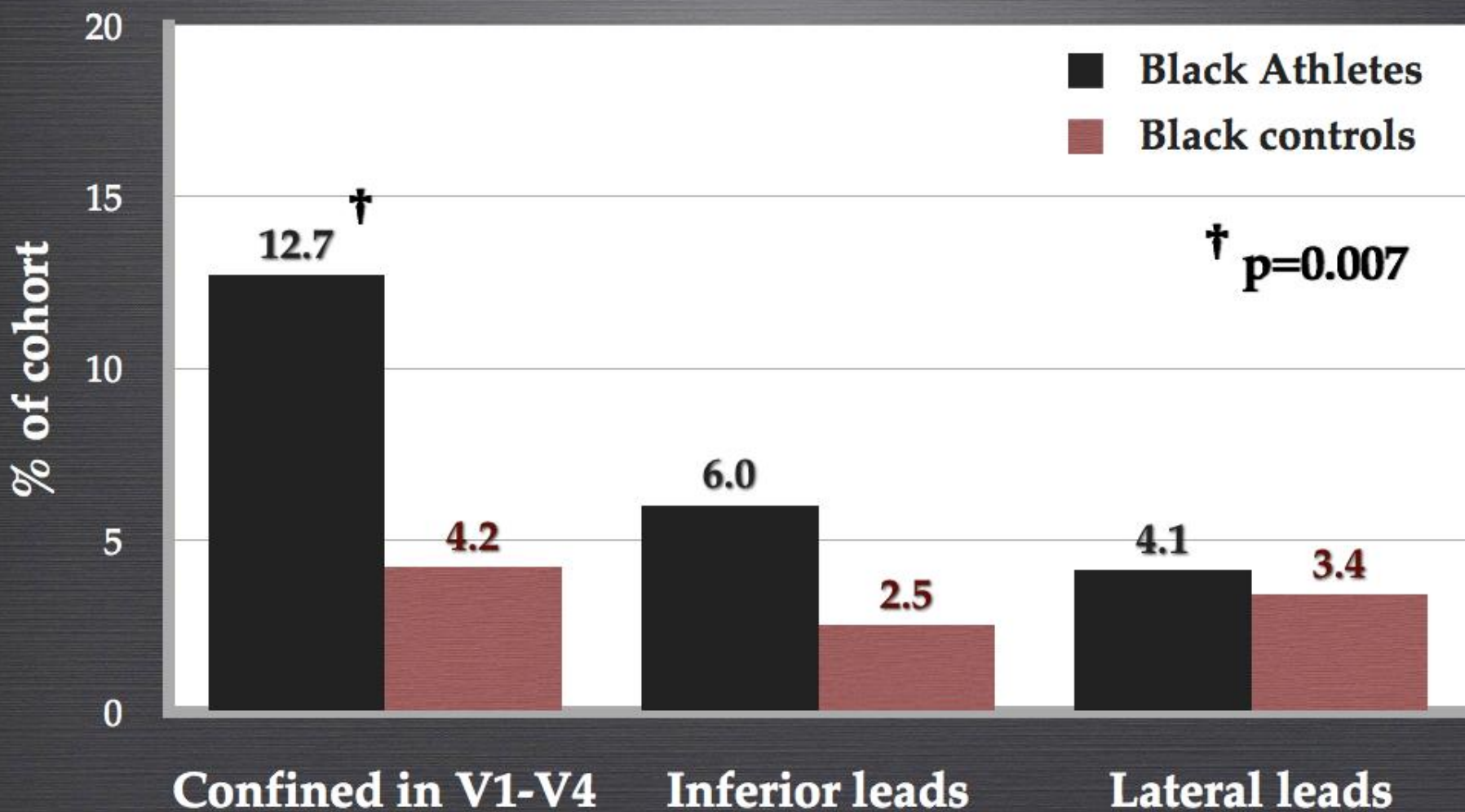
# BLACK ATHLETE'S ECG



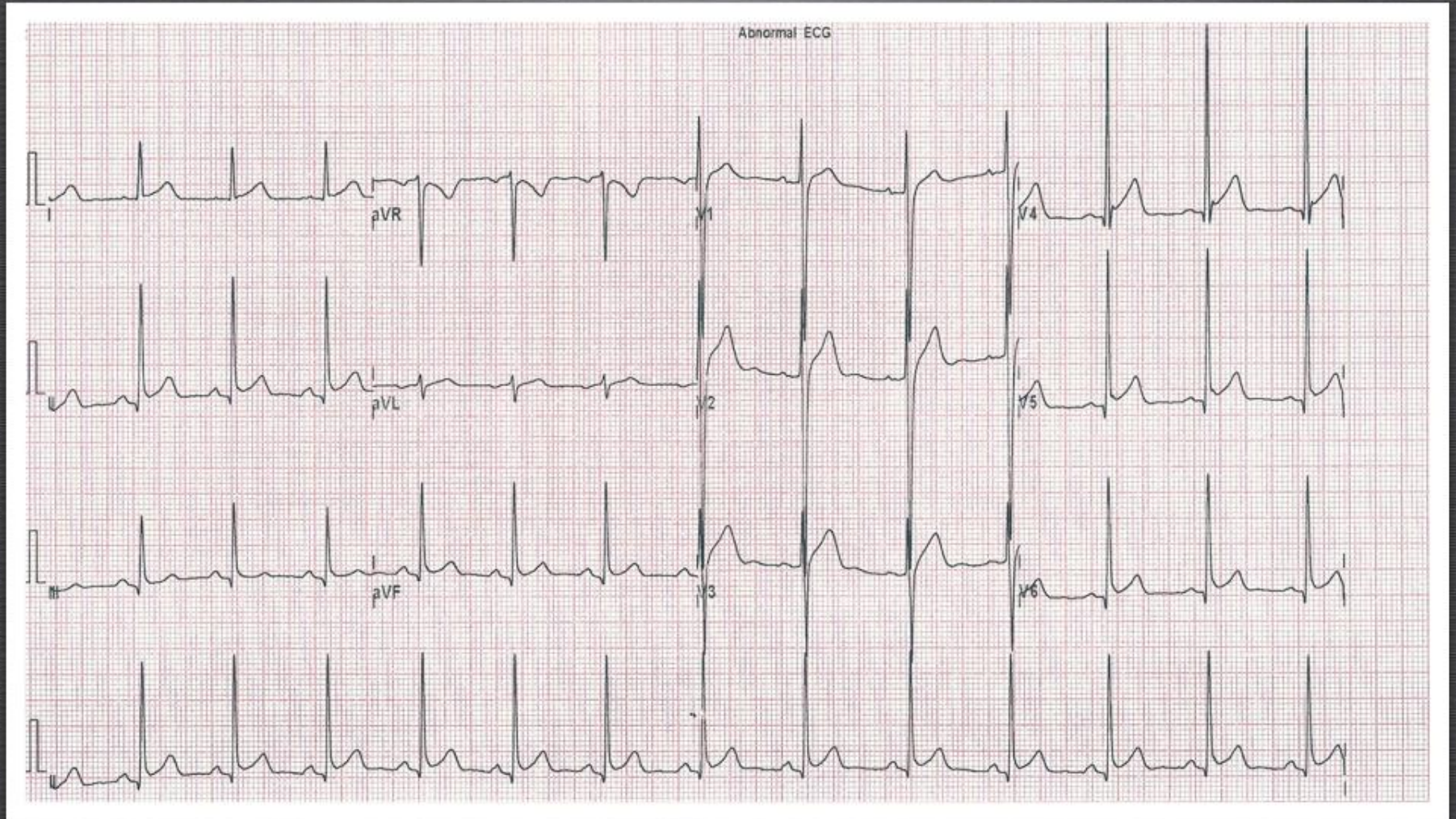
# ECG REPOLARISATION CHANGES BLACK ATHLETES VS. BLACK CONTROLS

|                      | <b>Black Athletes<br/>n=904</b> | <b>Black Controls<br/>n=119</b> | <b>p-value</b> |
|----------------------|---------------------------------|---------------------------------|----------------|
| <b>T-wave ↓</b>      | 22.8%                           | 10.1%                           | <0.001         |
| <b>Deep T-wave ↓</b> | 12.1%                           | 1.7%                            | <0.001         |
| <b>ST-segment ↑</b>  | 63.2%                           | 65.5%                           | 0.694          |
| <b>ST-segment ↓</b>  | 0.4%                            | 0                               | 0.694          |

# DISTRIBUTION OF T-WAVE ↓ BLACK ATHLETES VS. BLACK CONTROLS



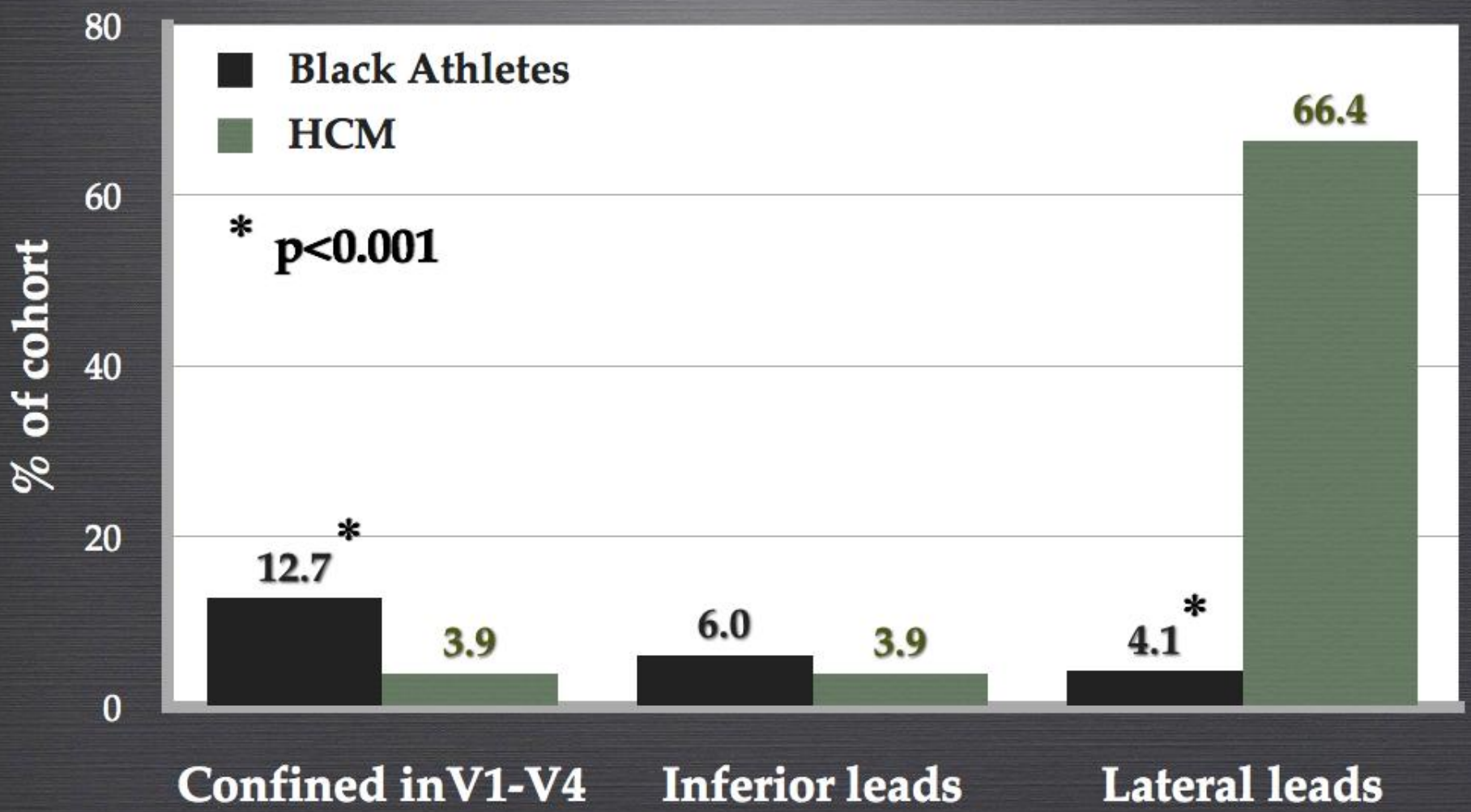
# BLACK CONTROL'S ECG



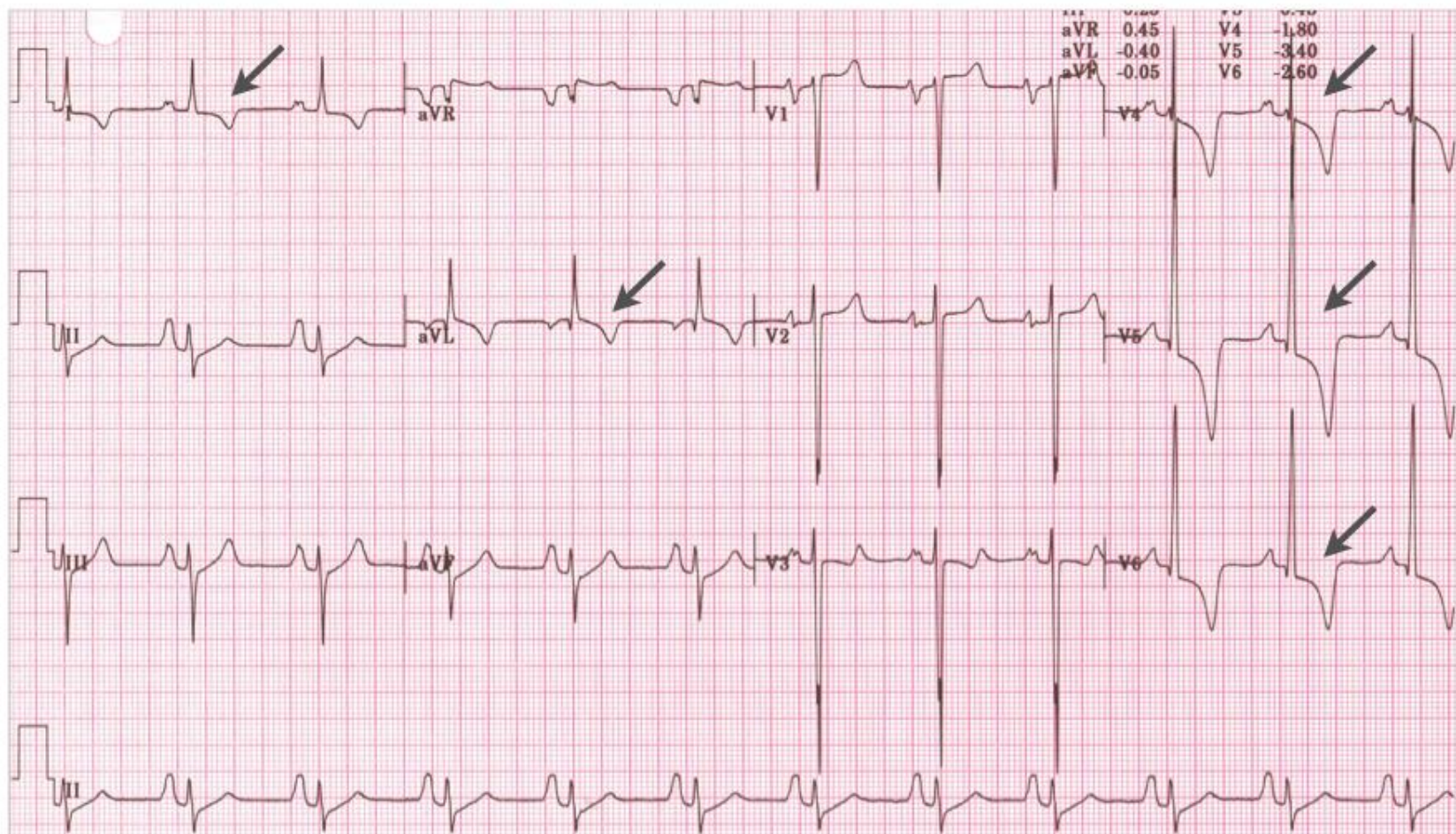
# ECG REPOLARISATION CHANGES BLACK ATHLETES VS. HCM

|                      | <b>Black Athletes<br/>n=904</b> | <b>HCM<br/>n=155</b> | <b>p-value</b> |
|----------------------|---------------------------------|----------------------|----------------|
| <b>T-wave ↓</b>      | 22.8%                           | 74.2%                | <0.001         |
| <b>Deep T-wave ↓</b> | 12.1%                           | 57.4%                | <0.001         |
| <b>ST-segment ↑</b>  | 63.2%                           | 9.7%                 | <0.001         |
| <b>ST-segment ↓</b>  | 0.4%                            | 40.0%                | 0.012          |

# DISTRIBUTION OF T-WAVE ↓ BLACK ATHLETES VS. HCM



# HCM ECG



|     |       |    |       |
|-----|-------|----|-------|
| aVR | 0.45  | V4 | -1.80 |
| aVL | -0.40 | V5 | -3.40 |
| aVF | -0.05 | V6 | -2.60 |

# DETERMINANTS OF T-WAVE ↓

## BLACK ATHLETES VS. WHITE ATHLETES

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- Univariable: Age, Ethnicity, Hours / week, SBP, LVWTd
- Multivariable:

|                 | OR    | 95% CI      | p-value |
|-----------------|-------|-------------|---------|
| Black vs. White | 5.556 | 3.546-8.696 | <0.001  |
| Max-LVWTd       | 1.175 | 1.023-1.349 | 0.023   |

# DETERMINANTS OF ST-SEGMENT ↑ BLACK ATHLETES VS. WHITE ATHLETES

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- Univariable: Age, Ethnicity, BSA, Hours/week, LVWTd, LA
- Multivariable:

|                       | OR    | 95% CI      | p-value |
|-----------------------|-------|-------------|---------|
| <b>Black vs White</b> | 3.953 | 2.732-5.747 | <0.001  |
| <b>Hours/week</b>     | 1.031 | 1.003-1.060 | 0.029   |

# CLINICAL SIGNIFICANCE OF REPOLARISATION CHANGES

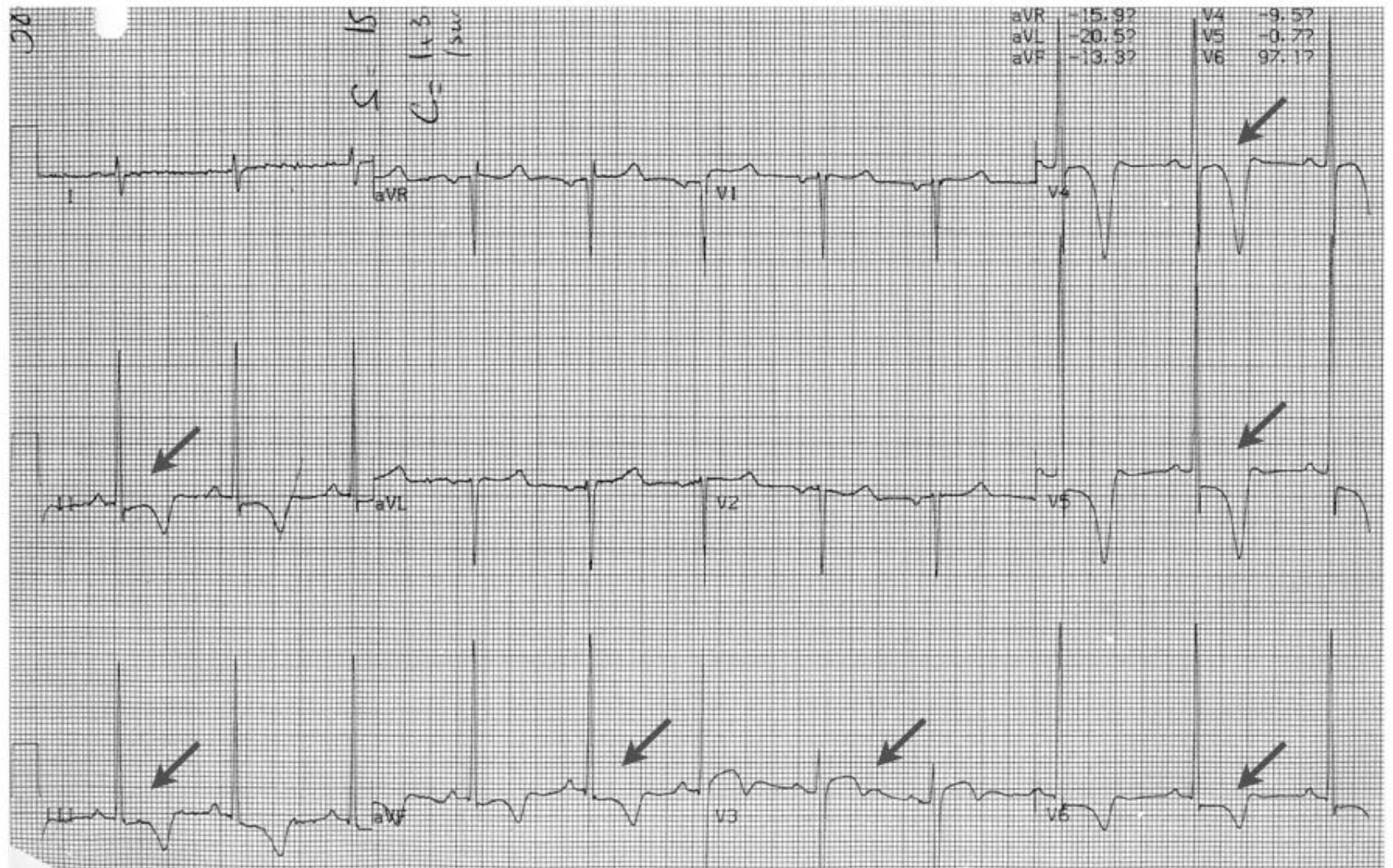
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- 69.7±29.6 months follow-up of 1243 athletes
  - 1 black athlete was diagnosed with HCM
  - 1 black athlete experienced aborted SCD
  - 1 white athlete was diagnosed with HCM

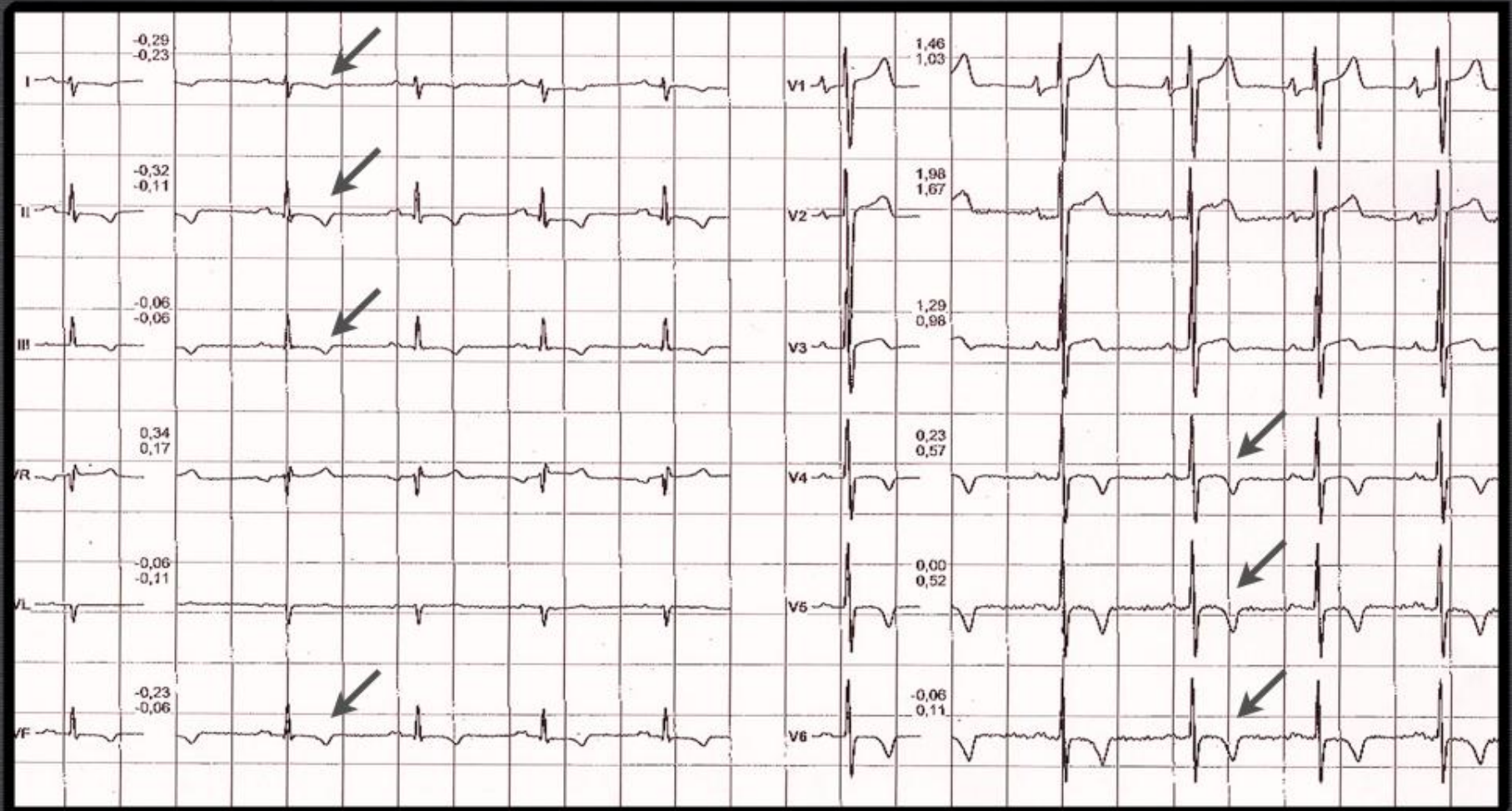
|          | LA | IVSd | LVPWd | LVEDd | LVM    | E/A  |
|----------|----|------|-------|-------|--------|------|
| BA + HCM | 42 | 15   | 12    | 48    | 302.09 | 1.83 |
| BA + SCD | 36 | 14   | 14    | 46    | 255.55 | 2.39 |
| WA + HCM | 34 | 11   | 9     | 49    | 175.01 | 2.4  |

- All had normal ETT, 24-48 hour holter, CMR

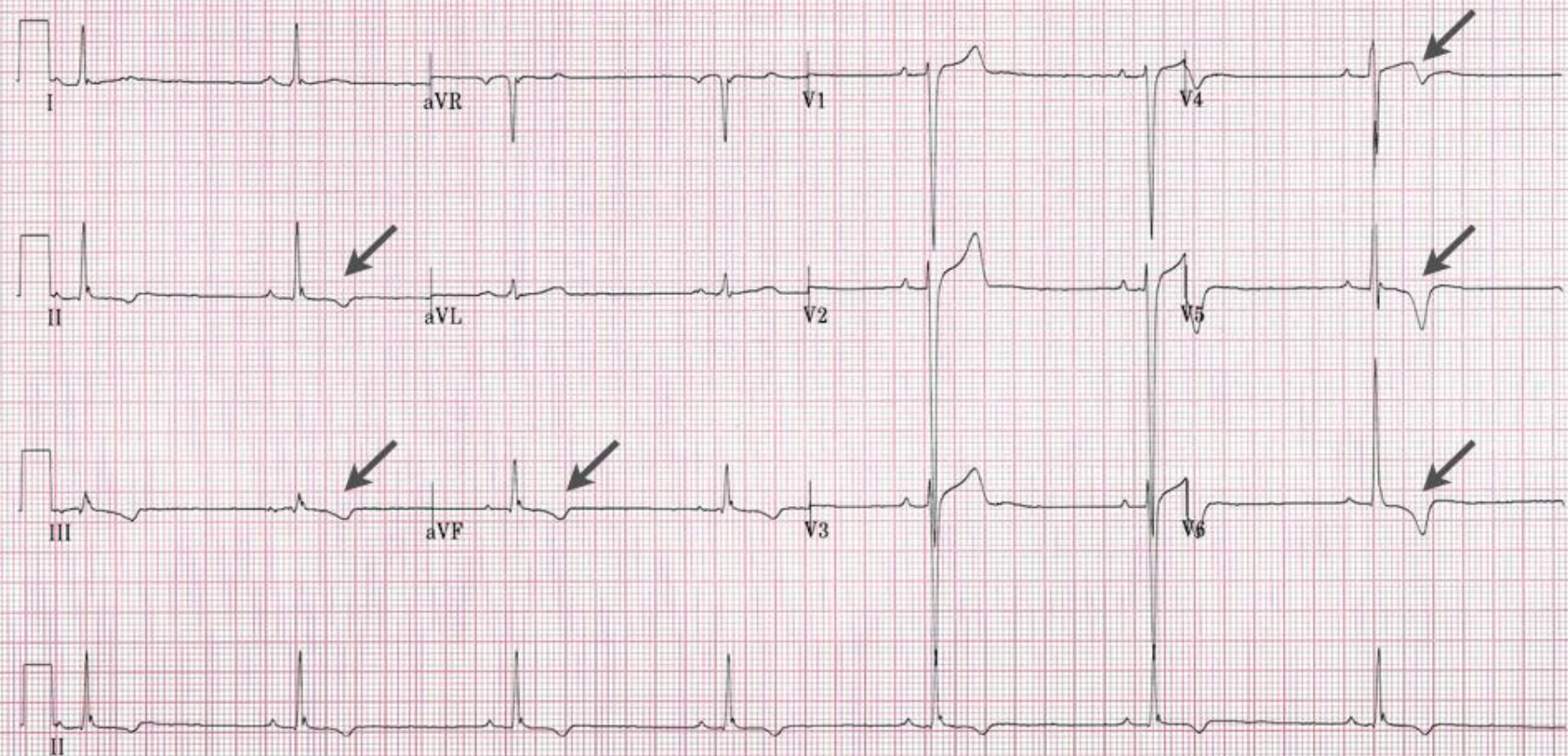
# BLACK ATHLETE WITH HCM



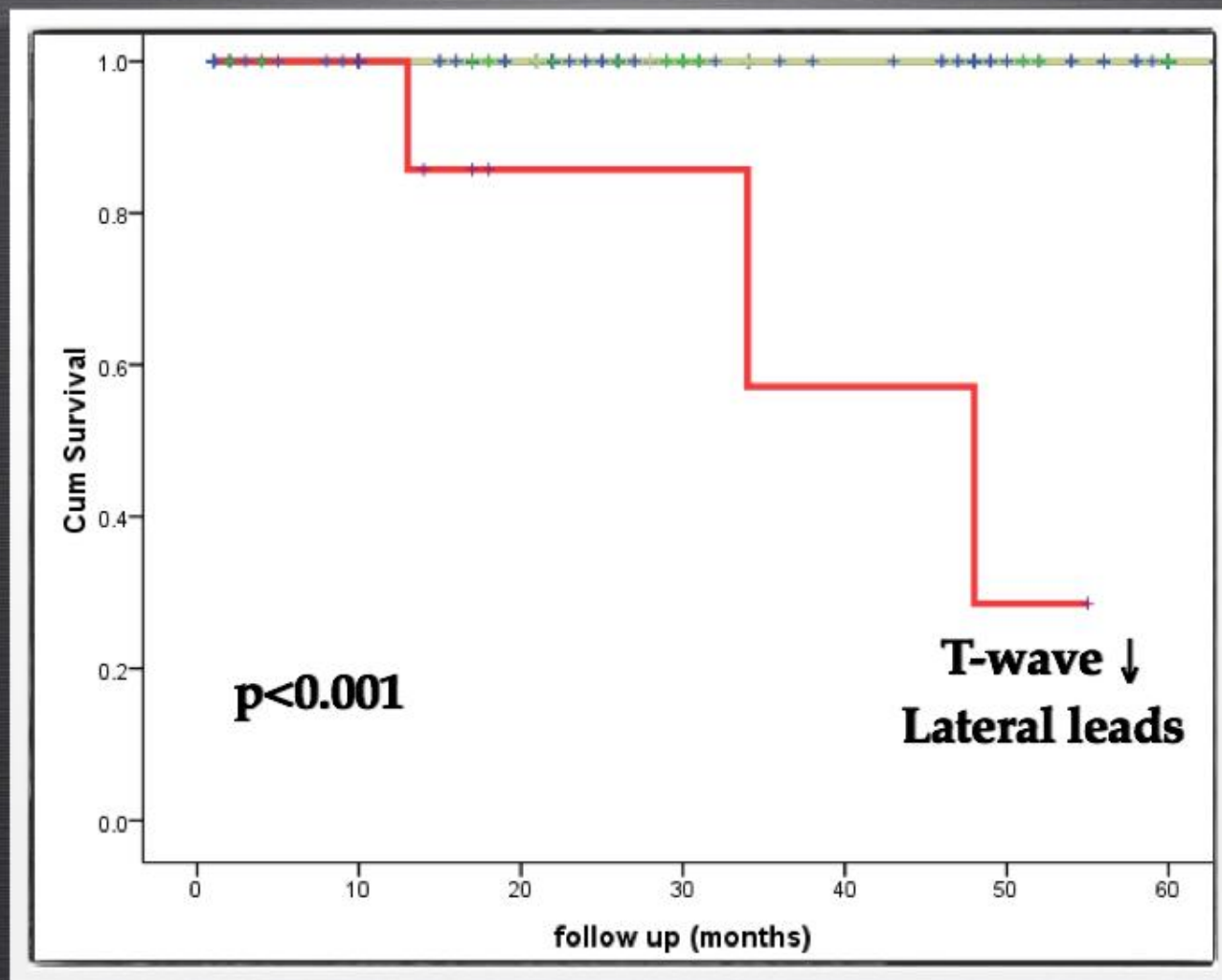
# BLACK ATHLETE WITH ABORTED SCD



# WHITE ATHLETE WITH HCM



# KAPLAN-MEIER ESTIMATES OF CUMULATIVE SURVIVAL FREE OF CARDIAC EVENTS/DIAGNOSIS



## DISCUSSION

### PREVALENCE OF REPOLARISATION CHANGES BLACK ATHLETES VS. WHITE ATHLETES

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- Black athletes exhibit more repolarisation changes
  - 23% T-wave ↓
  - 12% deep T-wave ↓
  - 63% ST-segment ↑
- Only 4% of black athletes exhibiting T-wave ↓ in lateral leads

# SIGNIFICANCE OF REPOLARISATION CHANGES BLACK ATHLETES VS. BLACK CONTROLS

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- Similar prevalence of
  - T-wave ↓ in inferior leads
  - T-wave ↓ in lateral leads
  - ST-segment ↑
- Black athletes have higher prevalence of
  - T-wave ↓ in V1-V4
- Indicating that T-wave ↓ in V1-V4 may represent cardiac adaptation to exercise

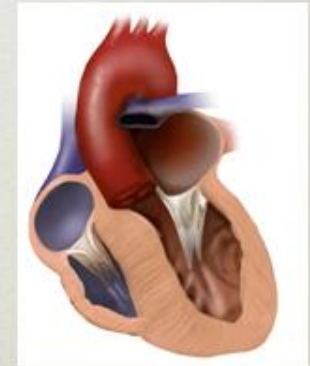
# SIGNIFICANCE OF REPOLARISATION CHANGES BLACK ATHLETES VS. HCM & FOLLOW-UP

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- 90% of T-wave ↓ in HCM patients; in lateral leads
- 40% of HCM patients exhibit ST-segment ↓
- All 3 athletes identified with HCM exhibited T-wave ↓ in the lateral leads

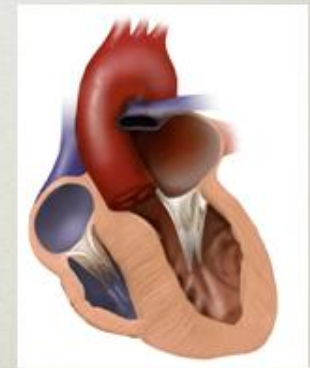
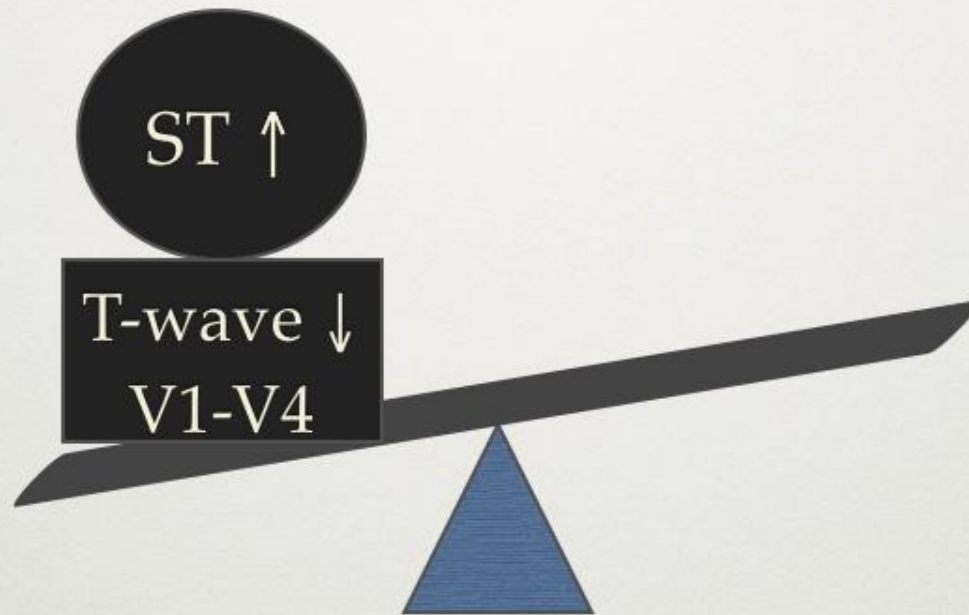
# RECOMMENDATIONS

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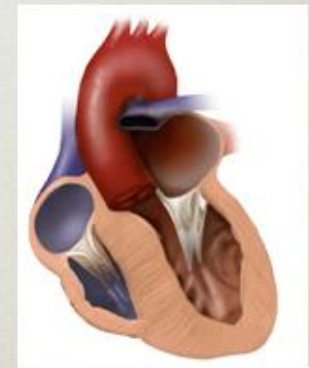
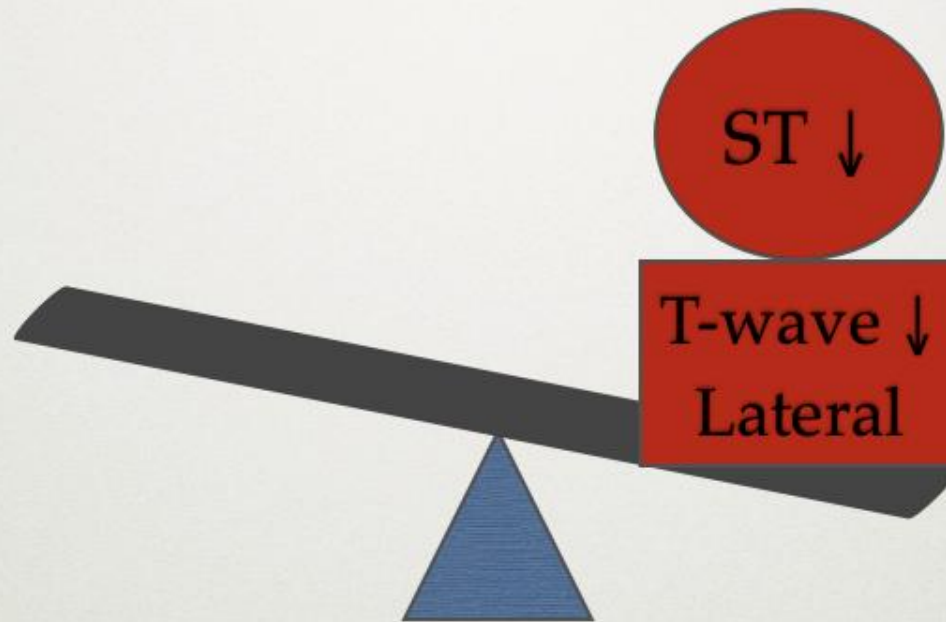
# RECOMMENDATIONS

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# RECOMMENDATIONS

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# ACKNOWLEDGEMENTS

- PROF F. CARRE AND DR G. KERVIO



The Lewisham Hospital

NHS Trust



**THANK YOU !!!!**