Early repolarization: Recognition and Management

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Early repolarization

Defined on Baseline ECGs as:
- Slurring (late delta) or notch at the end of QRS, with J point > 0.1mV (1mm) in ≥ 2 leads
- Left precordial and/or inferior and/or lateral ECG leads (excluding V1-V3 ie Brugada / ARVD)

F 24y IVF resuscitated April 2007

F Christine 39 yrs, no symptom, preoperative ECG
F Christine 1yr later: Sudden cardiac arrest while working on computer

Evidence of the pathological relationship with SCD
Evidences of the pathological relationship with SCD

1- Prevalence of « early repolarisation »
   - 31% (64/206) in pts with IVF vs 5% in the matched group (412) (p=0.002) (Haissaguerre NEJM 2008)
   - 60% of 15 patients with IVF (vs 3.3% controls) (Nam, NEJM 2008)
   - 42% in pts with IVF vs 13% in young athletes (Rosso et al. JACC 08)
   - 5.8% in the general population (Tikkanen JT et al. NEJM 2009)

2- Amplitude of J point
   - 2.15±1.2mm in IVF vs 1.05±0.2mm in controls with « early repolarisation »

3- Dynamicity of J wave: Instantaneous J/ST changes, Accentuation of repolarisation at the time of Arrhythmias
   - J/ST elevation from 2.6±0.1 to 4.1±2mV (p<0.001)
   - ECG of VF initiation in 18 pts
Evidences of the pathological relationship with SCD

1- Prevalence of « early repolarisation »
   - 34% (64/192) in pts with IVF vs 5% in the matched group (p<0.002) (Hauspurgue NEJM 2008)
   - 42% in pts with IVF vs 13% in young athletes (Rosso et al. JACC 08)
   - 5.8% in the general population (Yazawa K et al. NEJM 2009)

2- Amplitude of J point
   - 2.15±1.2mm in IVF vs 1.05±0.2mm in controls with « early repolarisation »

3- Dynamicity of J wave: Accentuation of repolarisation at the time of Arrhythmias
   - J/ST elevation from 2.6±0.1 to >4.1±2mV (p<0.001) ECG of VF initiation in 18 pts

4- Correlation location J/ST and Arrhythmia origin
Most VPB positive in V1–V2 (LV origin) Endocardial mapping and ablation in 8 pts
ST elevation localized in inferior leads associated with superior axis (origin in the inferior wall)
Widespread abnormal repolarization associated with extreme polymorphism in other ST location
Results: Clinical data

64 patients EAR; 10 had a familial history of SCD

- 18 female, *46 male, 35±13 years*

- VF occurred during **normal physical activity** in 26, at **rest** in 15, sleeping in 12* and effort in 6

- **Preceding syncope** in 24 (37%): prior ECG available described as ‘borderline or normal variant or early repolarization’

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Beat to beat fluctuations favor Repolarization rather than Depolarization

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Two ECGs 24 hours apart

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M 22yrs

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April 2004

March 2006
H 34yr, convulsions while sleeping, 2 ECGs the same day

7h

15h

RISK STRATIFICATION

FOLLOW-UP 60±42 months

Probability of no recurrence

IVF:23% recur

IVF+ Repolarization Abnormality: 43% recur

Time (Years)

Resistance to AA drugs of class Ib (7/7), Ic (10/10), BB (11/11), Amiodarone (7/8)

FOLLOW-UP

60±42 months

IVF: 23% recur

IVF+ Repolarization Abnormality: 43% recur

RISK STRATIFICATION

• J-point elevation in inferior leads
  – >0.1mV (5.8%) → RR cardiac death: 1.30 (CI: 1.05–1.61, p=0.02)
  – >0.2 mV (0.33%) → RR cardiac death: 3.03 (CI 1.88–4.90, p=0.001)
  – RR arrhythmic death: 2.99 (CI 1.49–6.03, p=0.005)

Stronger predictors than QT interval and LVH

Long-Term Outcome Associated with Early Repolarization on Electrocardiography
Jari T. Tikkanen, B.S., Olli Anttonen, M.D., M. Juhani Juristila, M.D.,
Asujo L. Arni, M.D., Tuomas Kerava, M.D., Hari A. Rickman, M.Sc.,
Antti Reunanen, M.D., and Heikki V. Hukkanen, M.D.


10864 patients (44 ±8 yo) Follow-up 30 ±11 years
Horizontal/descending ST segment

- Rosso R et al. Heart Rhythm 2011

Ascending ST segment → benign outcome

Horizontal/descending ST segment → poorer outcome

Risk of cardiovascular mortality
HR: 8.75 (CI 3.48-22.0, p<0.0001

Provocative manoeuvres in Early Repolarization

- 206 patients with IVF included
- 142 without Early Repolarization
- 64 with Early Repolarization

<table>
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<th>ERS</th>
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<td>81</td>
<td>83</td>
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<tr>
<td>0.96</td>
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From different centers
- France 10/28 (Bordeaux 6/10)
- Germany 1/7
- Belgium 3/4
- Japan 2/3
- Swiss 0/3
- Finland 0/2

Haïssaguerre et al. nejm 2008

Use of Body Surface Mapping

H 19y Twin brother

H 19y, his twin brother died from unexplained sudden death: evidence for inhomogeneous area

Y Rudy et al

Substrate of Ventricular Fibrillation with early repolarization

Male 23 years Resuscitated SD/VF while walking

Time: 4000 ms

LV inferior
No Pharmacological test to depict malignant Early Repolarization

Experimental background:
Antzelevitch work Yan, G.-X. et al. Circ 1996

- No change : Ajmaline, flecainide, cibenzoline, pilsicainide, verapamil, epinephrine, ATP, Ca
- Slight accentuation : bradycardia, Betablockers
- Decrease:
  • with Exercise/Isoproterenol (7/7pts) (increase in ICa-L current thus decrease electrical gradient, increase HR and reducing inactivation of Ito
  • and under Quinidine* (9/9pts) inhibits Ito.
• Both are powerful treatments for arrhythmic storms or multiple VF.

Haissaguerre et al. JACC 2009

Multiple episodes of VF and immediate correction by Iso infusion

Bernard A et al. JICE 2009

Dynamicity of the J-Wave in Idiopathic Ventricular Fibrillation With a Special Reference to Pause-Dependent Augmentation of the J-Wave

40 IVF/70 controls

1- pre- and post-J-wave amplitudes were larger with pause-dependent
2- augmentation only in pts with IVF (specificity and ppv 100%)

Aizawa et al JACC 2012

Multiple episodes of VF, correction by Quinidine

2002
14 yo girl
with > 50 ICD shocks
2007: 5 years later
No recurrence under quinidine
bisulf. 600mg bid
2010
ICD shocks
Blood level 1.1 µg/ml

Bernard A et al. JICE 2009

2002
2007
2010
2002
2007
2010
10 yo girl with syncope
Brother died suddenly at age 17
One month later
600 mg Hydroxyquinidine/day

Take Home Messages
- In the setting of resuscitated SCA
  - ICD
  - ± Isoproterenol in case of arrhythmic storm
  - ± Quinidine in case of recurrence
  - Familial screening
- In the setting of syncope
  - Characteristics of the syncope
  - Familial history of SCD
    > Clinical follow-up, ILR, ICD
- In asymptomatic patients
  - No pharmacological test yet
  - EPS seems useless for risk stratification
  - Useful for screening in familial SCD?
Conclusions

• The 2 major risk factors for VF in the setting of J wave elevation in infero-lateral leads are syncope and major J wave elevation.

• Isoproterenol and quinidine decrease the J wave amplitude and prevent VF recurrence.

• At present, we are lacking a pharmacological test to screen asymptomatic patients at risk of SCD.