ECG T-WAVE PREDICTORS OF POSITIVE AJMALINE TESTING AND MARKERS OF ARRHYTHMIC RISK IN PATIENTS WITH A POSITIVE AJMALINE TEST

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Brugada Syndrome

- Inherited cardiac condition
- Thought to be related to mutations in cardiac sodium channels (SCN5A)
- Characteristic ECG phenotype
- Associated with Sudden Cardiac Death and Ventricular Arrhythmias
- Management Of Arrhythmic Risk And When/If To Implant An ICD Remains Challenging
Diagnosis of Brugada ECG Phenotype

**Type 1**
- ≥2mm J-point elevation
- ≥2 Coved/concave ST-elevation
- T-wave inversion

**Non-Type 1 ECG**
- <2mm J-point elevation
- Convex/saddle-back ST-elevation ≥0.5mm.
- T-wave positive/bi-phasic
Brugada
ECG Varies with Time
Brugada
ECG Varies with Time
ECG Varies With Position

Diagnosis & Management

Figure 3. Proposed algorithmic approach to investigating for Brugada syndrome (A) and high precordial lead placement (B).
Ajmaline Testing – Pre Test
Ajmaline Testing – 2mins
Risk Stratification

The FINGER Brugada Syndrome Registry
*Circulation.* 2010;121:635-643
Augmented ST-Segment Elevation During Recovery From Exercise Predicts Cardiac Events in Patients With Brugada Syndrome

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Suta and Osaka, Japan
Fragmented QRS and Prognosis

n=115 cases

SCN5A pos in 33%
with fQRS vs 5%
without.

58% fQRS pos =VF
6% fQRS neg =VF

Morita et al, Circulation
2008:118;1697-1704
Figure 2. Kaplan-Meier analysis of arrhythmic events during follow-up depending on Tpeak-Tend interval (Tp-e) $\geq 100$ ms or Tp-e $<100$ ms.

Figure 4. Kaplan-Meier analysis of arrhythmic events during follow-up depending on Tpeak-Tend interval (Tp-e) dispersion $>20$ ms or Tp-e dispersion $\leq 20$ ms.
Transmural Repolarization Hypothesis

A Normal

B Brugada Syndrome (Saddleback)

C Brugada Syndrome (coved)

Transmembrane Action Potentials

ECG (V₂)

200 msec
Human Evidence of Epicardial APD delay

Nagase et al, JACC 2008
Non Invasive Mapping In Brugada

Junjie Zhang et al. 
Circulation. 
2015;131:1950-1959
What Does The T-wave Represent?
What Is Local On The Body Surface ECG
Methods

• A retrospective analysis of 199 patients who underwent ajmaline testing to further investigate
  • an abnormal ECG,
  • a family history of sudden cardiac death,
  • unexplained syncope or ventricular arrhythmia with Brugada Like ECG.

• Ajmaline was administered at 1mg/kg to a maximum of 100mg, with ECG recording in the high and standard right precordial leads.

• ECG data were then extracted and T-wave markers were analysed using custom designed Matlab software
Results

- Median age was 38yrs,
  - 103 patients were female.

- Ajmaline testing was positive in 41 patients and 22 patients went on to develop syncopal symptoms (n=12) or ventricular arrhythmia (n=10) over an 8 year period.
Schematic Of Measures On The Surface ECG

Upslope end (V1) to upslope end (V6)

V1

V6

Tpeak

Tend

TpTe

Tstart
Results

• Multivariate predictors of a positive Ajmaline test on the baseline ECG
  • Difference between the earliest T-wave start to the latest T-wave end
    • (p=0.03, OR 1.04, CI 1.01-1.09)

• The difference between the the end of the T-wave upslope in V2 to the end of the T-wave upslope in V6
  • (p=0.04, OR 1.02, CI 1.05-1.06).
Predictors Of A Positive Ajmaline Test

Predictors Of Positive Ajmaline Test

p = 0.04, OR 1.02

Upslope End Difference V2 to V6 (ms)
Results

• Multivariate predictors of VA or syncope from the baseline ECG were
  • TPeak-Tend in V2
  • The difference between the the end of the T-wave upslope in V2 to the end of the T-wave upslope in V6.

• Multivariate predictors of VA or syncope from the peak Ajmaline ECG
  • The difference between the the end of the T-wave upslope in V2 to the end of the T-wave upslope in V6.
Predictors Of Ventricular Events At Rest

\[ p = 0.02, \text{ OR } 0.96 \]
Predictors Of Ventricular Events At Peak Ajmaline

**Graph:**
- **Y-axis:** Upslope End Difference V2 to V6 (ms)
- **X-axis:** Ajmaline Neg vs. Ajmaline Pos
- **Statistical Information:**
  - **p = 0.03, OR 1.12**
Summary

• Differences between the end of the upslope in V2 and V6 at baseline were associated with a subsequent positive ajmaline test.
• Tpeak-Tend in V2 at baseline was associated with future VA or syncope.
• At peak Ajmaline Dose
  • Differences between the end of the upslope in V2 and V6 at baseline were associated with a subsequent positive ajmaline test.
• These findings have an important clinical impact for our future management of these patients, enabling us to better stratify those who need Ajmaline testing, and closely monitor risk in patients with a positive test.
Thank you

• Any questions..