A case reported of Brugada substrate ablation in a patient receive frequent ICD shock due to recurrent VT/VF

ChhangTea, MD
Tam Duc Cardiology Hospital, HCM city, VN.
Case presentation

A 37 year-old male patient with normal heart structure who received ICD implantation (June 2015) because of Brugada syndrome. After the implantation, he experienced 4 episodes of VF with appropriate ICD shocks (4 VF, 2015-2016), despite of Cilostazol 100mg/day and Bisoprolol 2.5mg/day.
Baseline ECG

IRBB, Cove type ST elevation 2mm follow by negative T wave in V1
Interrogate ICD

From June 2015 to October 2016

- ICD recorded 6 episodes of VF/NSVT
  - June 2015: 2 VF and 1 NSVT
  - October 2016: 2 VF and 1 NSVT
Interrogate ICD
What should we do next?

A. Nothing, ICD did a good job

B. I would start quinidine

C. I would start amiodarone

D. I would perform an epicardial ablation
# Specific Cardiac Channelopathy Syndromes
## Brugada Syndrome

<table>
<thead>
<tr>
<th>COR</th>
<th>LOE</th>
<th>Recommendations for Brugada Syndrome</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>B-NR</td>
<td>1. In asymptomatic patients with only inducible type 1 Brugada electrocardiographic pattern, observation without therapy is recommended.</td>
</tr>
<tr>
<td>I</td>
<td>B-NR</td>
<td>2. In patients with Brugada syndrome with spontaneous type 1 Brugada electrocardiographic pattern and cardiac arrest, sustained VA or a recent history of syncope presumed due to VA, an ICD is recommended if a meaningful survival of greater than 1 year is expected.</td>
</tr>
<tr>
<td>I</td>
<td>B-NR</td>
<td>3. In patients with Brugada syndrome experiencing recurrent ICD shocks for polymorphic VT, intensification of therapy with quinidine or catheter ablation is recommended.</td>
</tr>
</tbody>
</table>
Mapping and Ablation of Ventricular Fibrillation Associated With Long-QT and Brugada Syndromes

Michel Haïssaguerre, MD; Fabrice Extramiana, MD; Mélèze Hocini, MD; Bruno Cauchemez, MD; Pierre Jaïs, MD; Jose Angel Cabrera, MD; Geronimo Farre, MD; Antoine Leenhardt, MD; Prashanthan Sanders, MBBS; Christophe Scavée, MD; Li-Fern Hsu, MBBS; Rukshen Weerasooriya, MBBS; Dipen C. Shah, MD; Robert Frank, MD; Philippe Maury, MD; Marc Delay, MD; Stéphane Garrigue, MD; Jacques Clémenty, MD

Haissaguerre et al. Circulation 2003
Ablation of trigger

- Haïssaguerre et al, attempted catheter ablation to treat Brugada syndrome patients with recurrent VF.
- Brugada syndrome rarely have PVCs → this approach impractical.
Arrhythmia/Electrophysiology

Prevention of Ventricular Fibrillation Episodes in Brugada Syndrome by Catheter Ablation Over the Anterior Right Ventricular Outflow Tract Epicardium

Koonlawee Nademanee, MD; Gumpaart Veerakul, MD; Pakorn Chandanamattha, MD; Lertlak Chaothawee, MD; Aekarach Ariyachaipanich, MD; Kriengkrai Jirasirirojanakorn, MD; Khanchit Likittanasombat, MD; Kiertijai Bhuripanyo, MD; Tachapong Ngarmukos, MD
## Table 1. Clinical Characteristics of the Study Patients

<table>
<thead>
<tr>
<th>Patient</th>
<th>Age</th>
<th>Sex</th>
<th>BrS-ECG</th>
<th>VF Episodes per Month, n</th>
<th>Initial Symptoms</th>
<th>BrS ECG After, Yes/No</th>
<th>Inducible Before</th>
<th>Inducible After</th>
<th>Time from ICD to First Episodes, mo</th>
<th>Follow-Up Period, mo</th>
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<tr>
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<td>Noninducible</td>
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<tr>
<td>Median</td>
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</tr>
</tbody>
</table>

Aj indicates ajmaline; BrS, Brugada syndrome; ICD, implantable cardioverter-defibrillator; CA, cardiac arrest; and VF, ventricular fibrillation.
Substrate ablation

Nademannee et al. Circulation 2011
Brugada Syndrome Phenotype Elimination by Epicardial Substrate Ablation

Running title: Brugada et al.; Brugada Syndrome Phenotype Elimination

Josep Brugada, MD\textsuperscript{1*}; Carlo Pappone, MD, PhD\textsuperscript{2*}; Antonio Berruezo, MD, PhD\textsuperscript{1};
Gabriele Vicedomini, MD\textsuperscript{2}; Francesco Manguso, MD, PhD\textsuperscript{2}; Giuseppe Ciconte, MD\textsuperscript{2};
Luigi Giannelli, MD\textsuperscript{2}; Vincenzo Santinelli, MD\textsuperscript{2}

\textsuperscript{1}Arrhythmia Section, Cardiology Department, Thorax Institute, Hospital Clinic and IDIBAPS (Institut d’Investigació Agustí Pi i Sunyer), Barcelona, Catalonia, Spain; \textsuperscript{2}Arrhythmology Departments, Maria Cecilia Hospital, Cotignola and Policlinico San Donato, University of Milan, Milan, Italy

*contributed equally as first authors

Brugada et al., circulation 2015
Substrate ablation

- Study of 14 brugada syndrome receiving ICD

- The substrate ablation was target in condition without Flecainide and with Flecainide test

- 14/14 patients disappear brugada pattern after ablation and during 5 months follow up event with provocative test with flecainide

- 14/14 patient VT/VF non inducible after ablation

- 14/14 patient no ventricular event recorded during follow up

Brugada et al, circulation 2015
Substrate ablation

Brugada et al., Circulation 2015
Substrate ablation

Brugada et al., Circulation 2015
Substrate ablation

Brugada et al., Circulation 2015
Electrical Substrate Elimination in 135 Consecutive Patients With Brugada Syndrome

Carlo Pappone, MD, PhD*; Josep Brugada, MD, PhD*; Gabriele Vicedomini, MD; Giuseppe Ciconte, MD; Francesco Manguso, MD, PhD; Massimo Saviano, MD; Raffaele Vitale, MD; Amarild Cuko, MD; Luigi Giannelli, MD; Zarko Calovic, MD; Manuel Conti, MD; Paolo Pozzi, Eng; Andrea Natalizia, PhD, Eng; Simonetta Crisà, Eng; Valeria Borrelli, PhD; Ramon Brugada, MD, PhD; Georgia Sarquella-Brugada, MD, PhD; Marco Guazzi, MD; Alessandro Frigiola, MD; Lorenzo Menicanti, MD; Vincenzo Santinelli, MD
Group 1: 63 documented VT/VF and brugada related symptoms
27 patients: multiple ICD shocks, recurrent VT/VF

Group 2: 72 induced VT/VF, without ECG documented during symptoms

3D maps before and after ajmaline

Primary end point: Identification of arrhythmogenic substrate elimination (normalisation of ECG) and arrhythmias noniducible in all patients

Mean follow up: 10 months ECG remain normal + ajmaline, 2 patients repeat procedure due to recurrent VT/VF
A novel method to enhance phenotype, epicardial functional substrates, and ventricular tachyarrhythmias in Brugada syndrome

Fa-Po Chung, MD,†‡ Sunu Budhi Raharjo, MD,† Yenn-Jiang Lin, MD, PhD,†‡ Shih-Lin Chang, MD, PhD,†‡ Li-Wei Lo, MD, PhD,†‡ Yu-Feng Hu, MD, PhD,†‡ Ta-Chuan Tuan, MD,†‡ Tze-Fan Chao, MD,†‡ Jo-Nan Liao, MD,†‡ Chin-Yu Lin, MD,†‡ Yao-Ting Chang, MD,†‡ Yuan Hung, MD,† Abigail Te, MD,† Shinya Yamada, MD,† Hiroshi Tasaka, MD,† Chin-Tien Wang, MD,*, Shih-Ann Chen, MD†‡

From the *Institute of Clinical Medicine, National Yang-Ming University, Taipei, Taiwan, †Division of Cardiology, Department of Medicine, Taipei Veterans General Hospital, Taipei, Taiwan, and ‡Department of Medicine, National Yang-Ming University, Taipei, Taiwan.
Back to our case

- After giving consent form, patient has underwent the epicardial ablation
  - Ensite Velocity 4.0 (St. Jude)
  - CoolFlex irrigated catheter (St. Jude)
Mapping technique

- Gain access into the pericardial space for epicardial mapping.

- Endocardial and epicardial electroanatomic mapping of the RV.

- Abnormal electro-grams are defined as low voltage ($\leq 1$ mV); split electrograms or fractionated electrograms with multiple potentials with $\geq 2$ distinct components, long duration (480 ms) or late potentials,

- These abnormal electrograms are tagged as target sites for ablation procedures.
Access to pericardial space
Access to pericardial space
3D Mapping: Substrate epicardial mapping
3D Mapping: Substrate epicardial mapping
Substrate ablation
Post Ablation
Absence of VT, VF for 6 month without medication
1 recurrence of VF 6 months later after one episode of viral infections

Now stable under cilostazol 100mg/day (1.6 years)
ECG during follow up
Conclusions

• Epicardial substrate ablation for BrS is safe and effective.

• Need to eliminate all abnormal substrate.

• Ablation does not exclude the necessity of ICD.
Bibliography

- Brugada et al. Brugada Syndrome Phenotype Elimination by Epicardial Substrate Ablation, Circulation 2015


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- Fa-Po Chung, MD et al. A novel method to enhance phenotype, epicardial functional substrates, and ventricular tachyarrhythmias in brugada syndrome, Heart Rhythm 2017;14:508–517