Why these ventricular tachycardia patients required redo ablation?

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The importance of VT ablation

- CA is an important option to control VTs
  - Ablation is often a sole therapy of VT in patients without structural heart disease
  - Ablation is commonly combined with an ICD and/or antiarrhythmic therapy for VTs associated with structural heart disease
The mechanisms of VT

- **Structural Heart Disease---scar-related reentry**
  - MI, ARVC, sarcoidosis, Chagas’ disease, DCM, and after cardiac surgery for CHD

- **Idiopathic---Focal VT**
  - Automaticity
  - Triggered activity
  - microreentry

- Automatic VTs can occur in structural heart disease, and automatic premature beats may initiate reentrant VTs
Catheter ablation results of VT ablation

- **Idiopathic VT**
  - Acute procedural success is approximately 90%
  - 10-15% need redo procedure

- **VT with structural heart disease**
  - Acute success rate 80%
  - But nearly 50% of patients with structural heart disease experiencing VT recurrence at long-term follow-up post CA

The possible reasons of VT which requires redo ablation

- Misdiagnosis or the mechanism unexplainable
- Inaccurate location of the VT origin due to the limitations of mapping techniques
- VT was not inducible or unmappable during the procedure
- VT was deep inside or epicardial
- VT substrate was not sufficiently modified or progressive
- Poor contact force and lesion recovery
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- VT was deep inside and energy was restricted
- VT substrate was not sufficiently modified or progressive
- Poor contact force and lesion recovery
Misdiagnosed Case

- Male, 27 ys
- Slow pathway modification for AVNRT twice
sinus

. tachycardia
Unexplainable VT

- 16 year-old male who had a history of frequent palpitation and chest pain without syncope
- VT was refractory to antiarrhythmic drugs and became incessant one month before referring to our hospital
- Previous ablation attempt was failed in the other hospital
Clinical VT

110bpm
Frequent sinus capture when VT slow down; 102bpm
Holter Recording

120bpm

83次/分
## Pre-Procedure Exam

2-DE

### 超声心动图检查报告单

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### 检查描述:

左室增大，余室室大小正常范围；二尖瓣开放幅度减低，CD段平直，EPSS增宽，各瓣膜回声及开放尚可；室间隔与左室后壁厚度正常，室壁搏动弥温性减弱；主动脉、主肺动脉内径未见异常。

CDFI及PDE可探及二尖瓣、三尖瓣返流征象。

### 超声提示:

心功能不全
轻度二尖瓣关闭不全
轻度三尖瓣关闭不全

### 报告医生: 陈莉

### 报告日期: 2011-7-21

此报告仅供临床参考
High density decapolar catheter was placed to record HIS and RB.
Reversed activation sequence of sinus beat and VT

Sinus capture reset the tachycardia
VT could not be terminated by 20mg ATP bolus injection
3-D Activation Mapping

Decapolar Cath
Early DP?
Ablation target

32 ms
1875 BPM
Pace Mapping

Pacing at the earliest site
VT Termination
RBB potential during SR after Ablation

Recording RBB potential by Abl Catheter
Sinus Rhythm after Ablation
Ablation Target on 3-D Map
Fluoroscopy of VT Target

PA

LAO
VT recurred one day after the initial procedure and redo was successful.
The possible reasons of VT which requires redo ablation

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- Inaccurate location of the VT origin due to the limitations of mapping techniques
- VT was not inducible or unmappable during the procedure
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- Poor contact force and lesion recovery
Mapping techniques for VT

- Pacing mapping
- Activation mapping
- Entrainment mapping
- Three-dimensional electroanatomical mapping
  - Activation mapping
  - Substrate mapping
  - Pacing mapping
  - Combined strategy
The limitation of pace mapping

The spatial resolution of a good pace map for targeting VT is 1.8 cm² in the RVOT.

Pace mapping is unreliable in identifying the site of origin (20% patients).
The limitation of pace mapping

Preferential Conduction From the LCC Origin to the RVOT or Left Ventricular Septum

Ischemic VT case

- 53 ys, M
- OMI 2 ys ago
- Recurrent VTs
Voltage Map during SR
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The prevalence of epicardial substrates in VT patients with structural heart disease

- Russo AD; et al. Cir AE. 2012, Epub ahead of printed
- Michael P. Riley, Circ AE. 2010;3:332
Epicardial Ablation for Ventricular Tachycardia
A European Multicenter Study

Paolo Della Bella, MD, FESC; Josep Brugada, MD; Katja Zeppenfeld, MD; Jose Merino, MD; Petr Neuzil, MD; Philippe Maury, MD; Giuseppe Maccabelli, MD; Pasquale Vergara, MD, PhD; Francesca Baratto, MD; Antonio Berruezo, MD; Adrianus P. Wijnmaalen, MD

Background—The purpose of this study was to describe the epicardial percutaneous ablation experience of 6 European high-volume ventricular tachycardia (VT) ablation centers.

Methods and Results—Data from 218 patients with coronary artery disease (CAD, n=85 [39.0%]), idiopathic dilated of patients with idiopathic VT cardiomyopathy (ARCD/C, n=13 [6%]), arrhythmogenic right ventricular dysplasia/cardiomyopathy (ARVC/C, n=4 [2.3%]), and absence of structural heart disease (n=48 [22%]) undergoing epicardial subxyphoid access for VT ablation were collected. The epicardial approach was attempted as first-line treatment in 78 patients (35.8%). Acute prevention of VT inducibility was obtained in 156 patients (71.6%). There were no procedure-related deaths. Cardiac tamponade occurred in 8 patients, and abdominal hemorrhage in 1 patient. Six patients died of electrical storm recurrence within 48 hours from the procedure. After a mean follow-up of 17.3±18.2 months, 60 patients (31.4%) presented with VT recurrence (39.3% of IDCM patients; 34.7% of CAD patients; 30.8% of ARVD/C patients; 25% of HCM patients; 17.1% of patients with idiopathic VT). Twenty patients (10.4%) died during follow-up (12 of heart failure, 2 of cardiac arrest, and 6 of extracardiac causes).

Conclusions—In experienced centers, epicardial ablation of VT has an acceptable risk and favorable outcome. In selected patients, it is reasonable to consider as a first-line ablation approach. (Circ Arrhythm Electrophysiol. 2011;4:653-659.)

ARVC: more extensive epicardial area of electrogram abnormalities

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38 ± 33 cm²  

95 ± 47 cm²

Forty-nine ARVC patients with VT

First procedure

group 1, n=23
Endocardial ablation

52.2% (12/23)

group 2, n=26
endo-epicardial ablation

84.6% (22/26)

follow-up at least 3 years
freedom from VAs or ICD therapy

P=0.029
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- Poor contact force and lesion recovery
New circuit

Theoretical reentry circuits related to an inferior infarct scar before and after ablation
New circuit
Lack of Uniform Progression of Endocardial Scar in Patients With recurrence VT

ARVC with recurrence VT

Michael P. Riley, Circ AE. 2010;3:332
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A case of DCM with 9 VTs

- A 26-year old man with frequent palpitation and dizziness
- Sustained pleomorphic VTs were detected
- Five members suffered from sudden death in his family
- DCM was diagnosed and ICD was implanted in 2010
- Shocks were delivered frequently due to VTs storm
- Referred to our institution for VT ablation
Endocardium substrate mapping and ablation
X-ray of endo abl zone

Zone 1

Zone 2
Epicardial substrate mapping

Blue point: double potentials
Epicardial substrate mapping

yellow point: isolate potential
Isolated potentials between two scars
Epicardial substrate mapping

Pink point: fragmented potential
Epicardial substrate mapping

Dark blue point: late potential
LP between two scars
Epicardium substrate mapping and ablation
X-ray of epi abl zone

Zone 1

Zone 2
After epi and endo abl

VT still could be induced
VT Epi target pace

Epi target for the slow VT
X-ray of last abl target
After epi re-abl, no VTs induced
VT recurred 3 months after
Another DCM VT case

- Male, 45-year-old
- NYHA: III
- ECG: LBBB (140ms)
- Echo: EF=30% (Simpson), LVED=68mm
- Holter: PVCs and NSVT

Idiopathic Dilated Cardiomyopathy
CRT-D (Medtronic 7285) implantation on June 18th, 2008

Two Clinical VTs: 2008-06-18
CRT-D Log

VT/VF Episode List Report

Last Interrogation: Oct 11, 2009 11:34:55
Episodes Last Cleared: Jun 18, 2008 18:40:19

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VT/VF Episode #80 Report

Episode #80 - VT
Chart speed: 25.0 mm/sec
Previous Catheter Ablations

• First: Endo/Epi
• Second: Epi only
LV low voltage area
Late Pacing sites
Fractionated Double P Ablation

○ Late P  ○ Pacing sites
○ Double P  ○ Fractionated  ○ Ablation
Perfect pace mapping
Relationship between LV lead and the scar
Post second procedure

- VT storm occurred 2 months later
- VT storm occurred 6 months later
- LV function not improved
Decision of open chest mapping and ablation and LV lead epicardial replacement

- Previous two epicardial ablations via subxiphoid approach: pericardial adhesion was suspected
- VT recurred twice after epicardial ablation might be due to poor tissue contact or pericardial fat
- Transvenous LV lead was not placed at the dissynchronized area limited by coronary venous structure and its proximity to the border zone of the scar area
Healthy and the latest activation area, away from the scar.
Follow up result

- During follow-up, no VT storm occurred with drug therapy of the previous regimen except 11 events of slow VT with the cycle length of 480~520ms.
- The LV function was slightly improved with EF of 38% and symptoms were alleviated.
Home messages for VT ablation

- Detailed EP study and careful mapping should be performed
- Mapping strategy should be combined or individualized
- Preventive ablations should be done besides clinical VT ablation
- Energy delivery or the contact force must be increased at certain areas
Thank you for your attention!