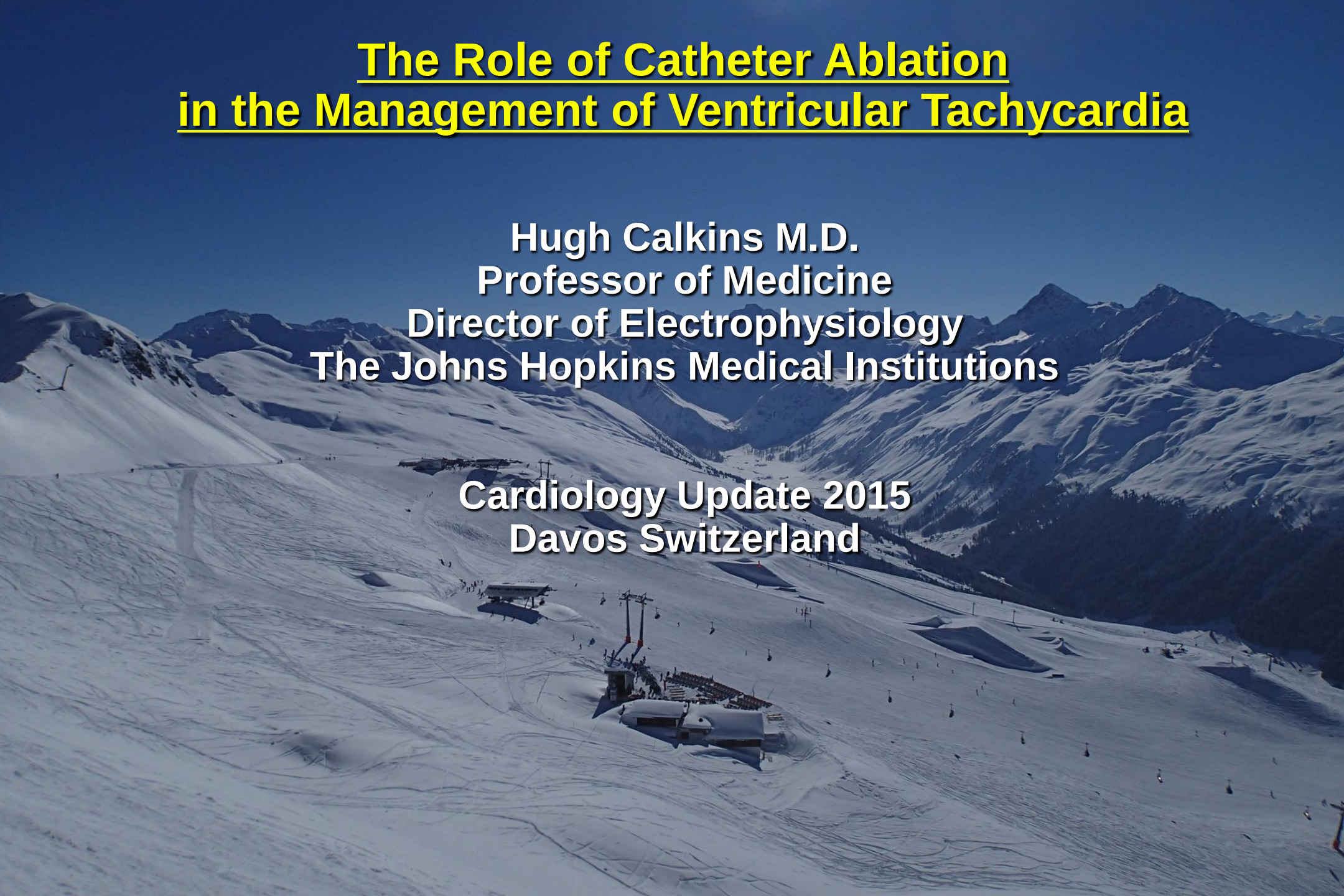


The Role of Catheter Ablation in the Management of Ventricular Tachycardia

Hugh Calkins M.D.
Professor of Medicine
Director of Electrophysiology
The Johns Hopkins Medical Institutions

Cardiology Update 2015
Davos Switzerland



Disclosures

Consultant and /or Honoraria:

Daiichi Sankyo

Boehringer - ingelheim

Atricure

Medtronic

St Jude Medical

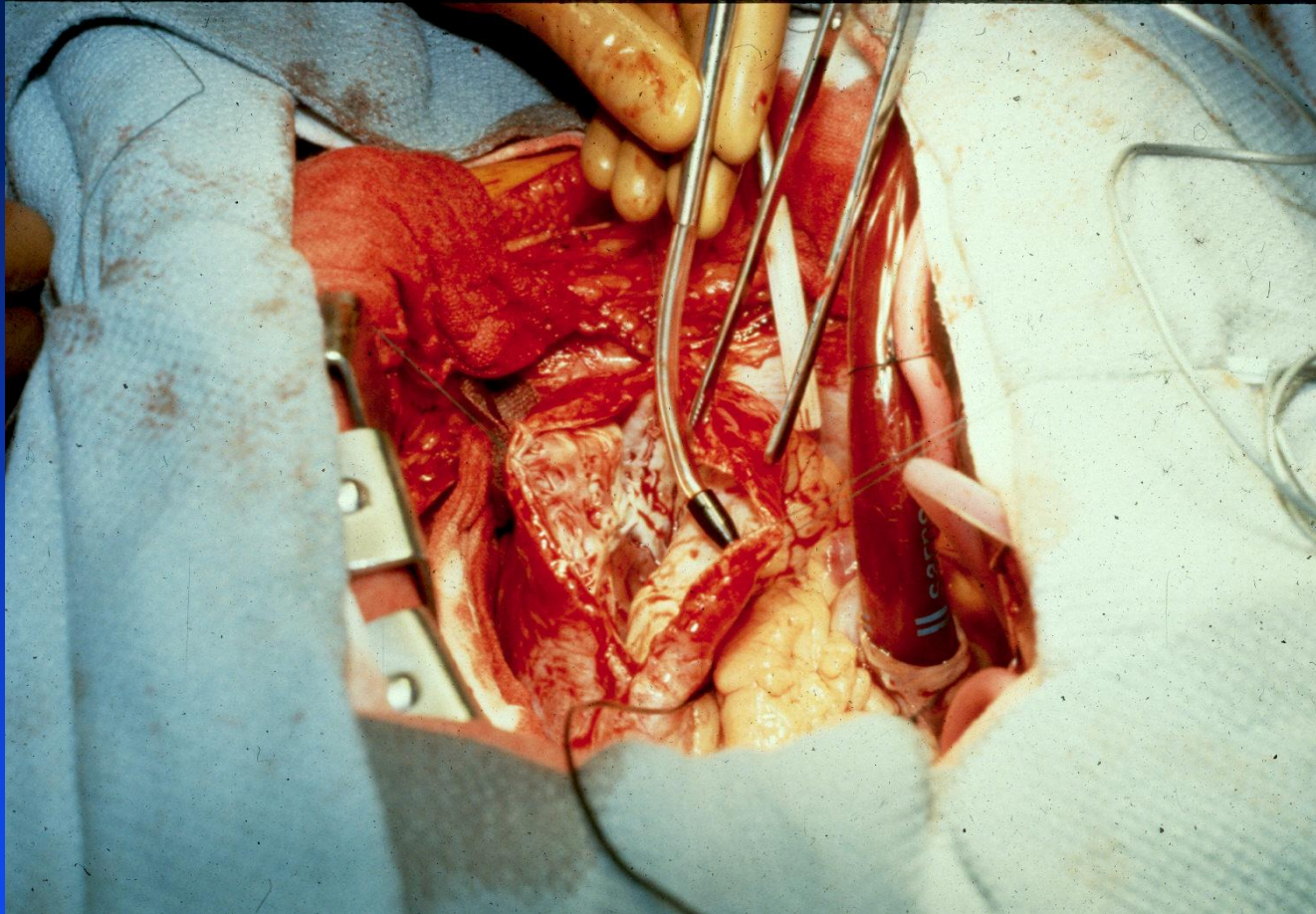
Goals

- **Historical Perspective on VT Ablation**
- **Technique and Role of Catheter ablation for Treatment of Idiopathic VT**
- **Technique and Role of Catheter Ablation for Treatment of VT in Patients with Structural Heart Disease**
- **Current Status of Multicenter Clinical Trials of VT Ablation**
- **Conclusion and Final Thoughts**

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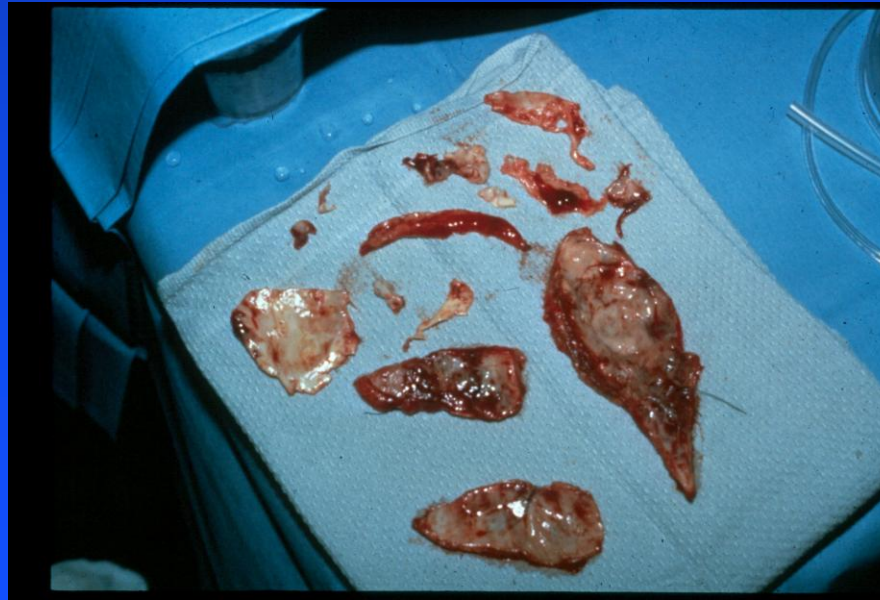
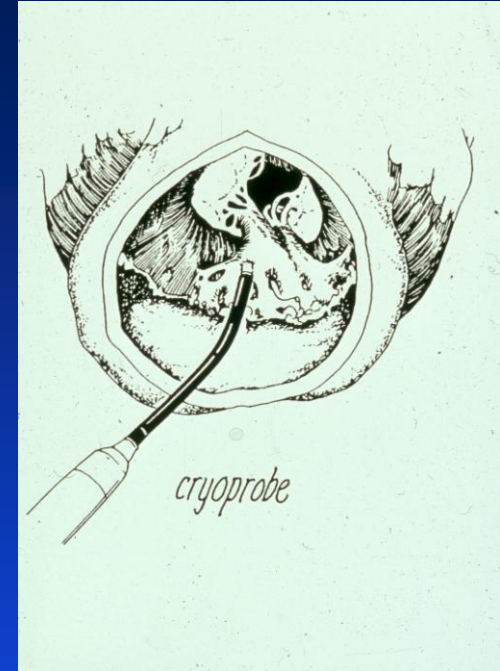
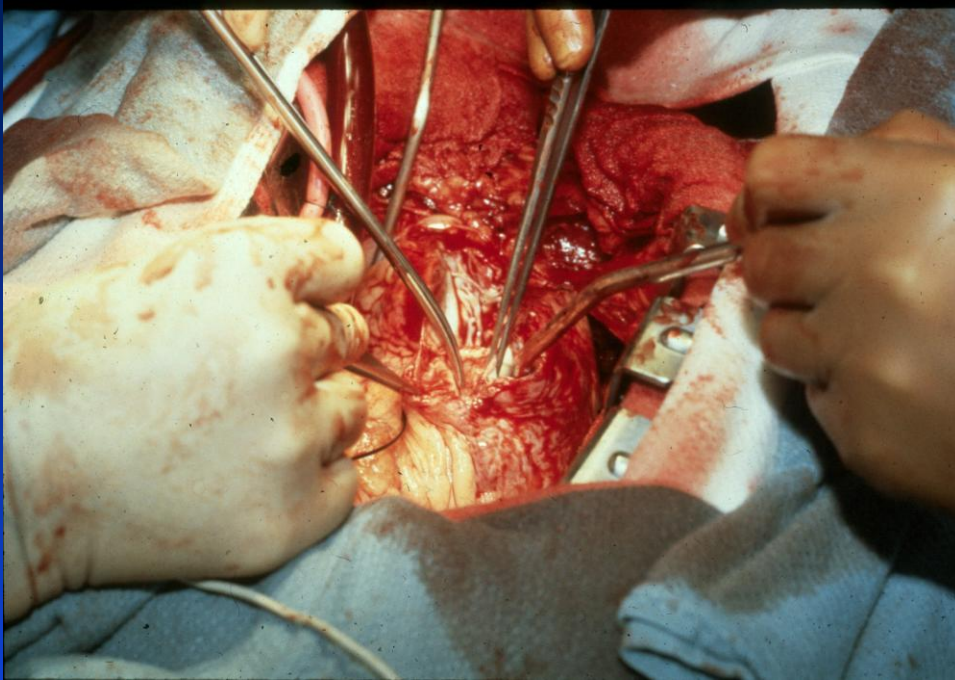
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Surgical Treatment of Ventricular Tachycardia



- first reported in the mid 1970' s
- Guiraudon; “encircling endocardial ventriculotomy”
- Josephson, Harken; “endocardial excision”

Surgical Treatment of Ventricular Tachycardia



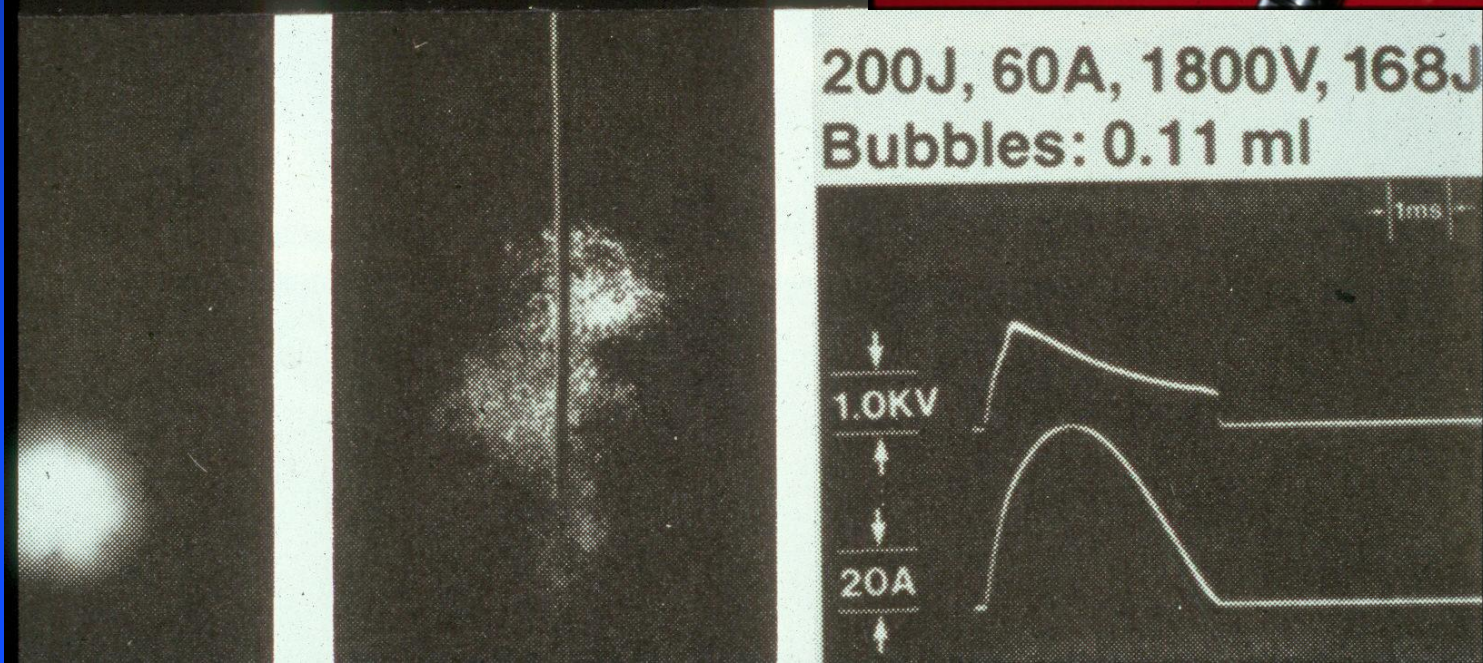
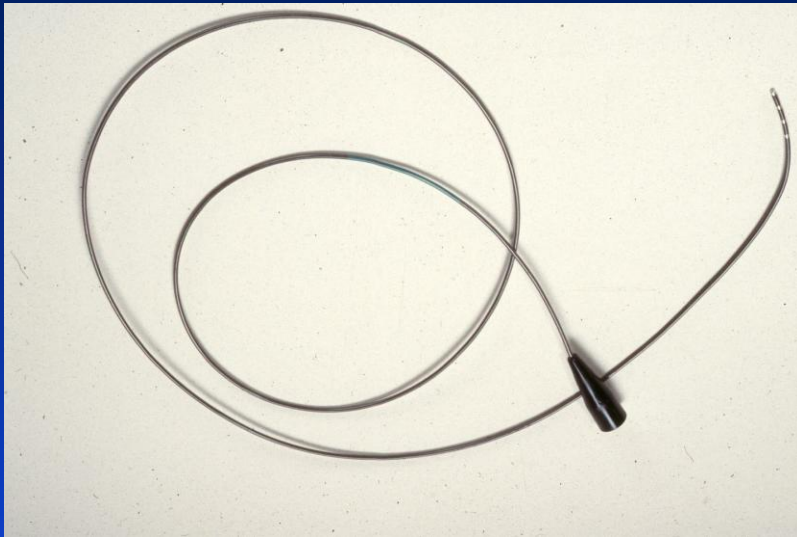
SURGICAL/ABLATIVE THERAPY

Author	Institution	Year	# Pts	Operative Mortality	% NI	Recurrence Rate*	Follow-up Duration
Josephson	Penn	1982	60	8%	76	5%	19±11
Miller	Penn	1984	100	9%	72	9%	28±19
Keho	N.W.	1985	79	13%	77		
Platia	Hopkins	1986	28	11%	80	10%	25
Krafeck	Baylor	1986	39	10%	97	9%	22±17
Garan	MGH	1986	36	17%	66		25±15
Swerdlow	Stanford	1986	98	16%	68	20%	23±21
Ostermeyer	Dusseldorf	1987	93	5%	81	10%	26
Haines	UVA	1988	45	9%	85	11%	19±12

* of patients that are NI

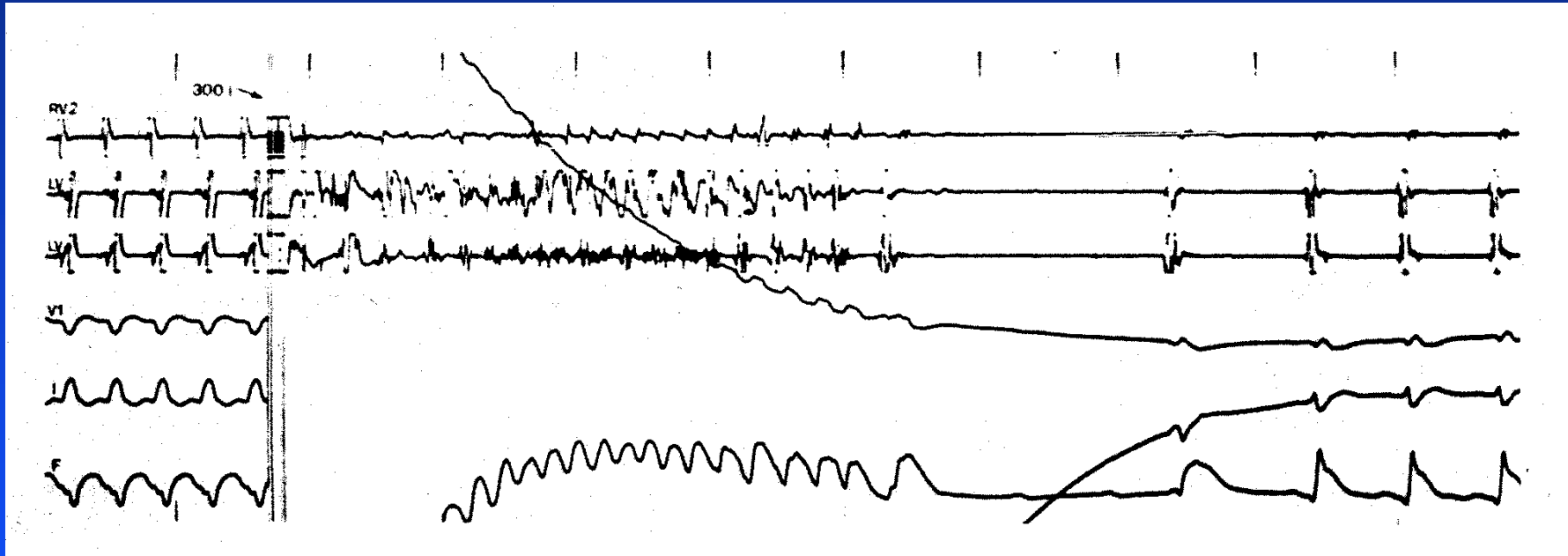
Catheter Ablation Using DC Shock Energy

Gallagher et al, N Engl J Med 306: 194, 1982



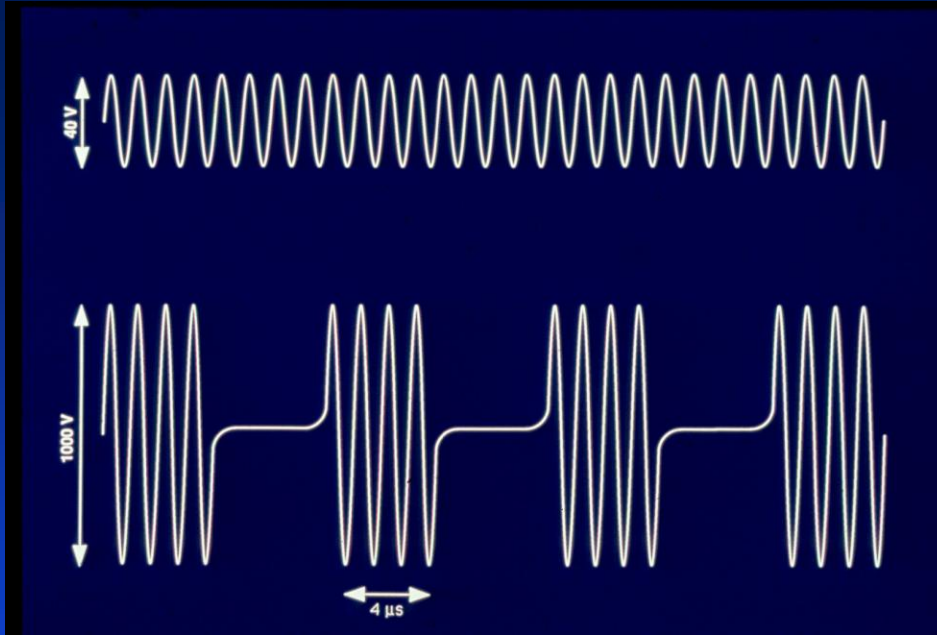
Electrode Catheter Ablation of Refractory Focal Ventricular Tachycardia

Geoffrey O. Hartzler, MD, FACC
JACC 1983; 2: 1107 - 1113

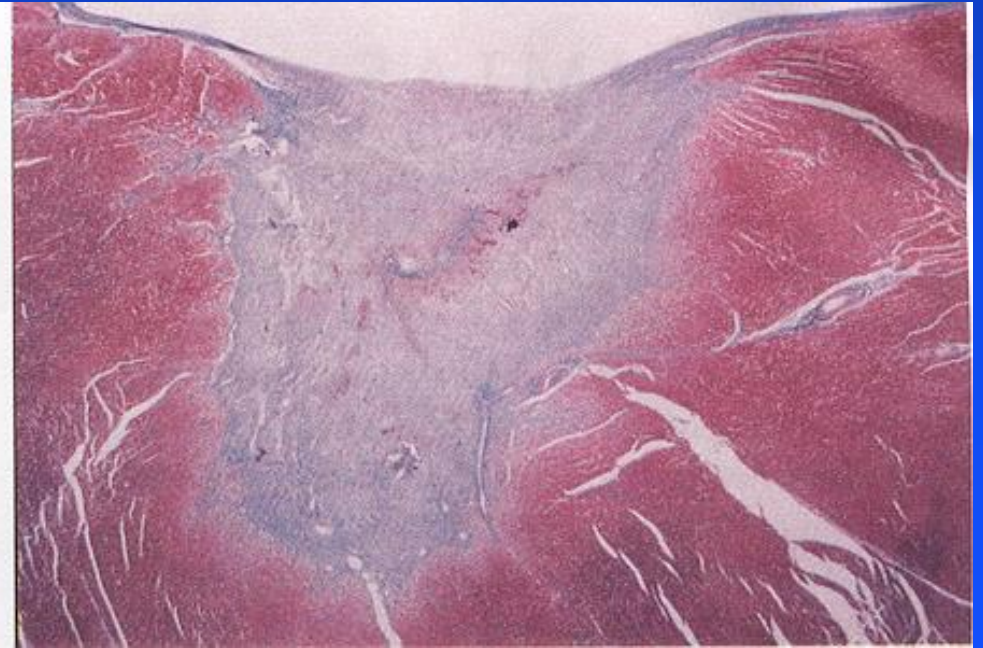
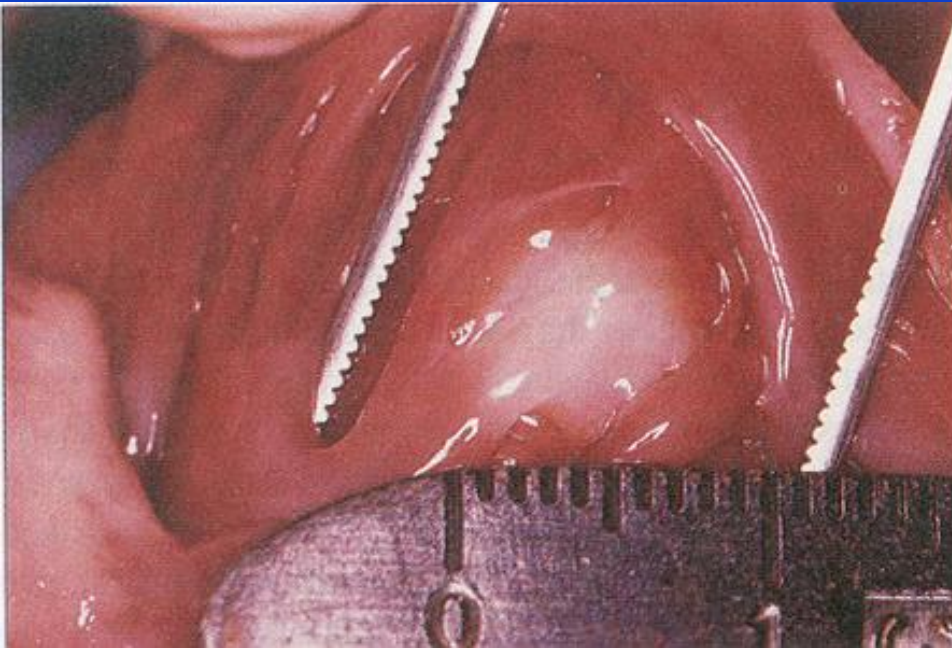
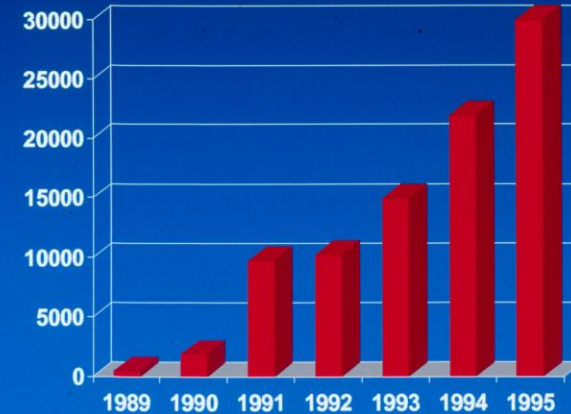


3 patients underwent DC shock ablation
1 – idiopathic RVOT VT
2 – recurrent VT after failed aneurysmectomy

The Era of RF Ablation: 1989 - present



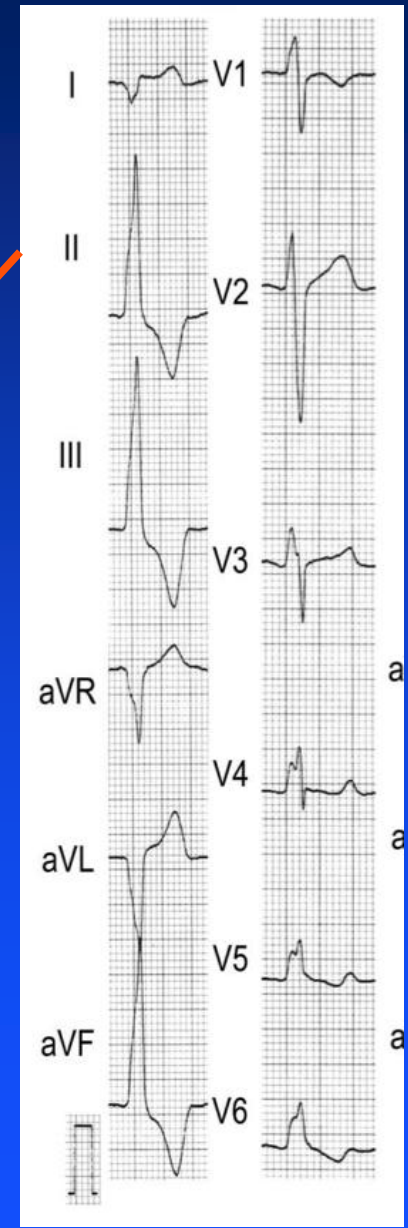
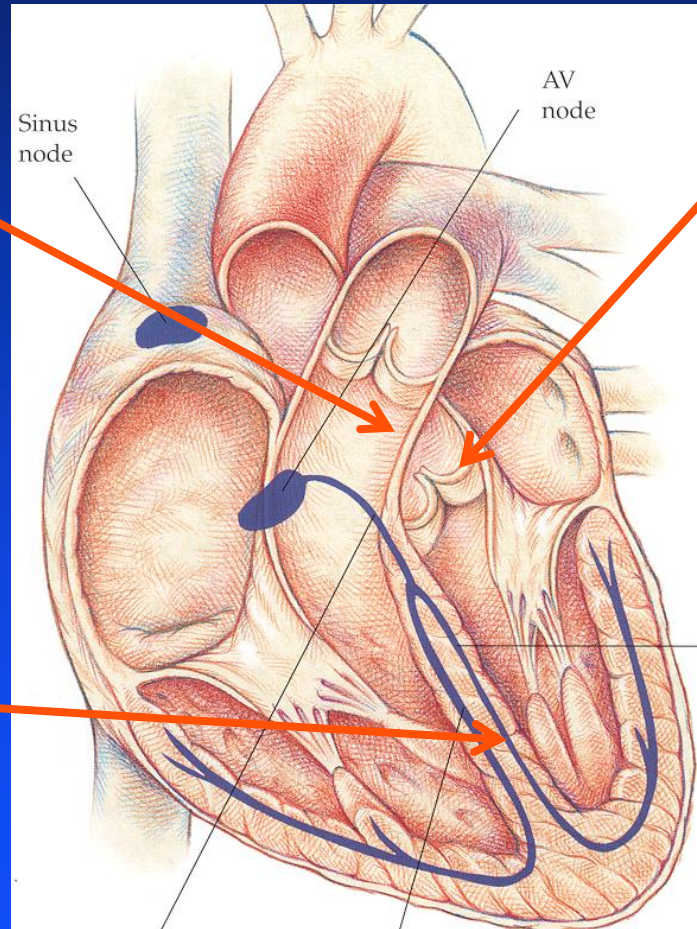
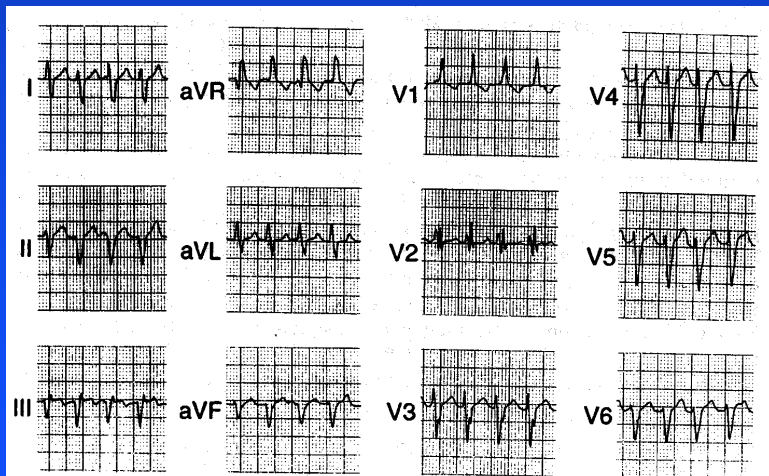
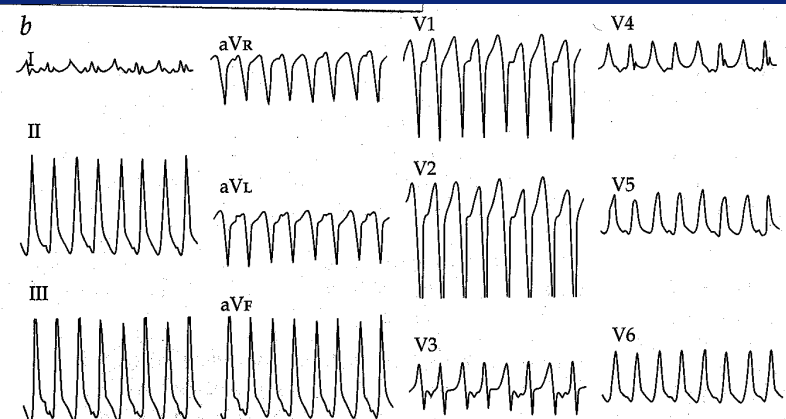
Catheter Ablation Procedures in the United States
1989 - 1995

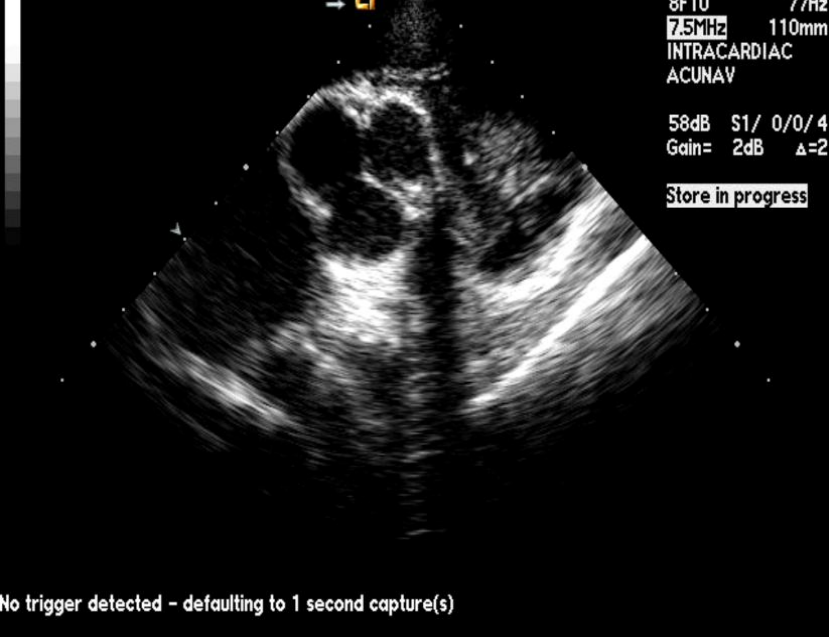


Goals

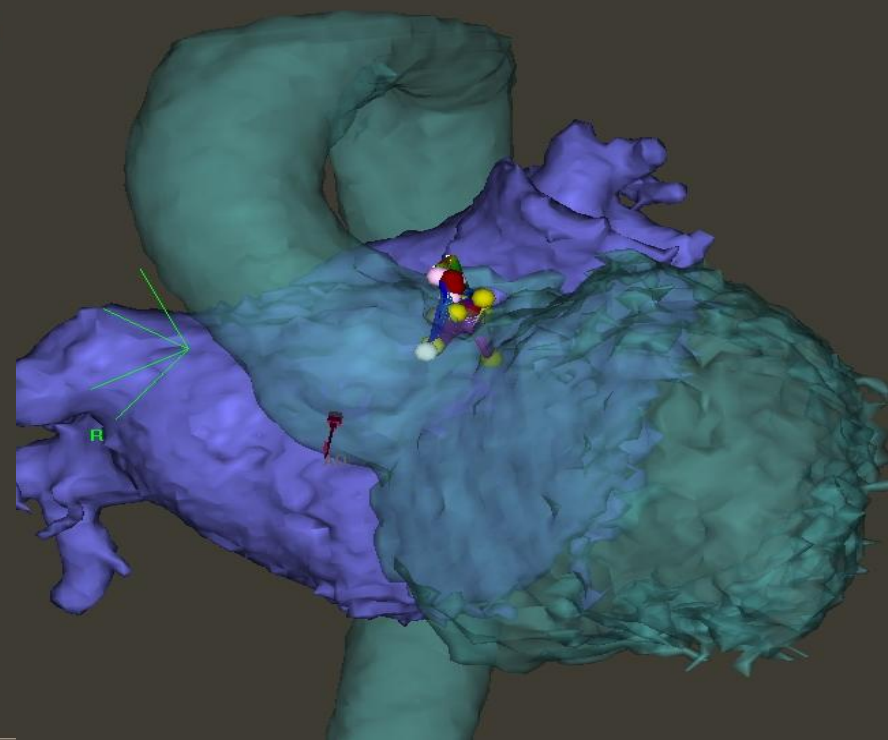
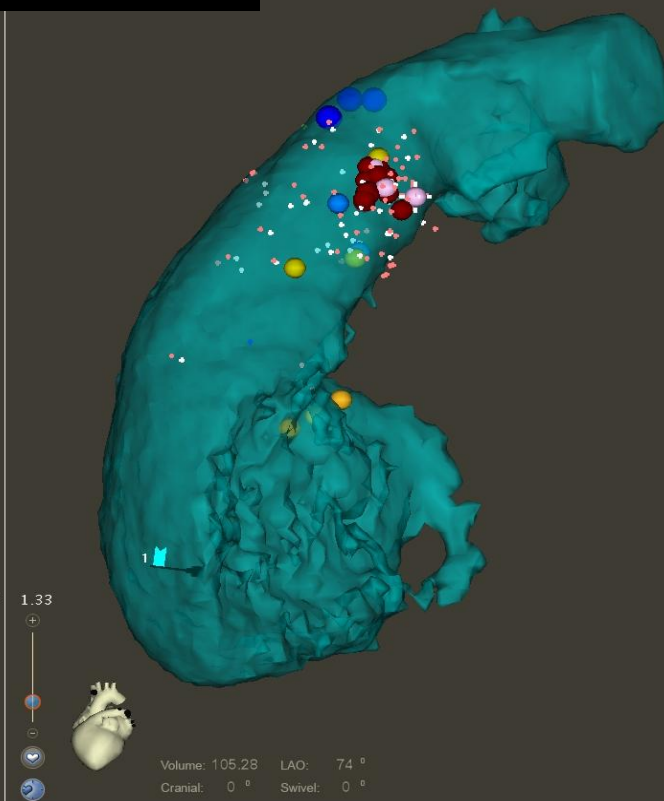
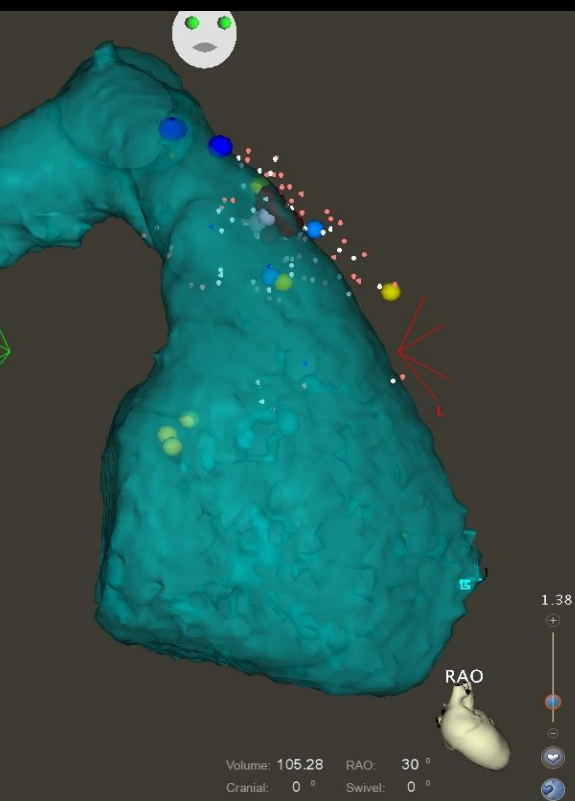
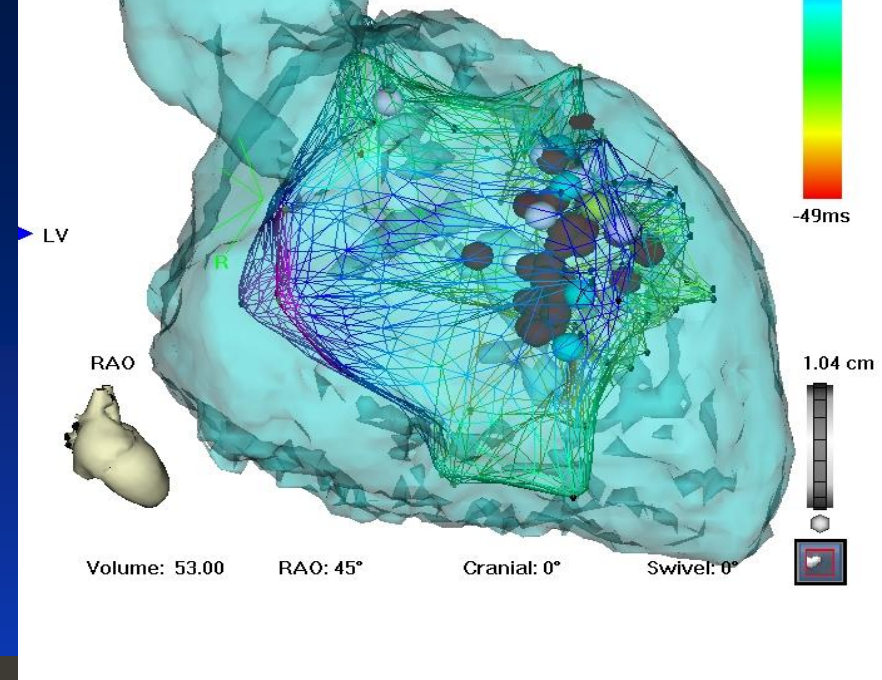
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Idiopathic Ventricular Tachycardia





New Mapping Tools



Outcomes of Catheter Ablation of Idiopathic Ventricular Tachycardia

- **Acute Efficacy** **> 90 %**
- **Long Term Efficacy / Cure** **$\geq 85\%$**
- **Major Complications** **< 1%**
- **Clinical Role** **First line**

EHRA/HRS Expert Consensus on Catheter Ablation of Ventricular Arrhythmias

Developed in a partnership with the European Heart Rhythm Association (EHRA), a Registered Branch of the European Society of Cardiology (ESC), and the Heart Rhythm Society (HRS); in collaboration with the American College of Cardiology (ACC) and the American Heart Association (AHA)

Etienne M. Aliot, MD, FESC, FHRS,¹ William G. Stevenson, MD, FHRS,²
Jesus Ma Almendral-Garrote, MD, PhD,³ Frank Bogun, MD,⁴ C. Hugh Calkins, MD, FHRS,⁵
Etienne Delacretaz, MD, FESC,⁶ Paolo Della Bella, MD, PhD, FESC,⁷ Gerhard Hindricks, MD, PhD,⁸
Pierre Jaïs, MD, PhD,⁹ Mark E. Josephson, MD,¹⁰ Josef Kautzner, MD, PhD,¹¹ G. Neal Kay, MD,¹²
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Francis Marchlinski, MD, FHRS,¹⁵ Vivek Reddy, MD,¹⁶ Martin-Jan Schalij, MD, PhD,¹⁷
Richard Schilling, MD,¹⁸ Kyoko Soejima, MD,¹⁹ and David Wilber, MD²⁰

Heart Rhythm, Vol 6, No 6, June 2009

Catheter ablation of VT is recommended for patients with idiopathic VT

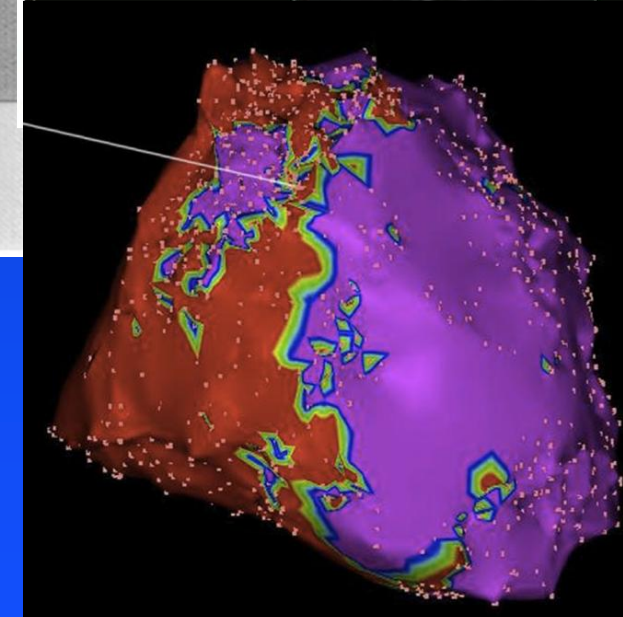
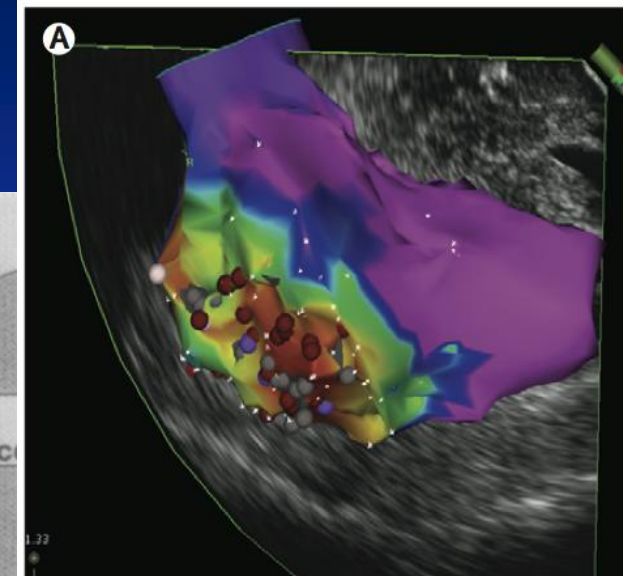
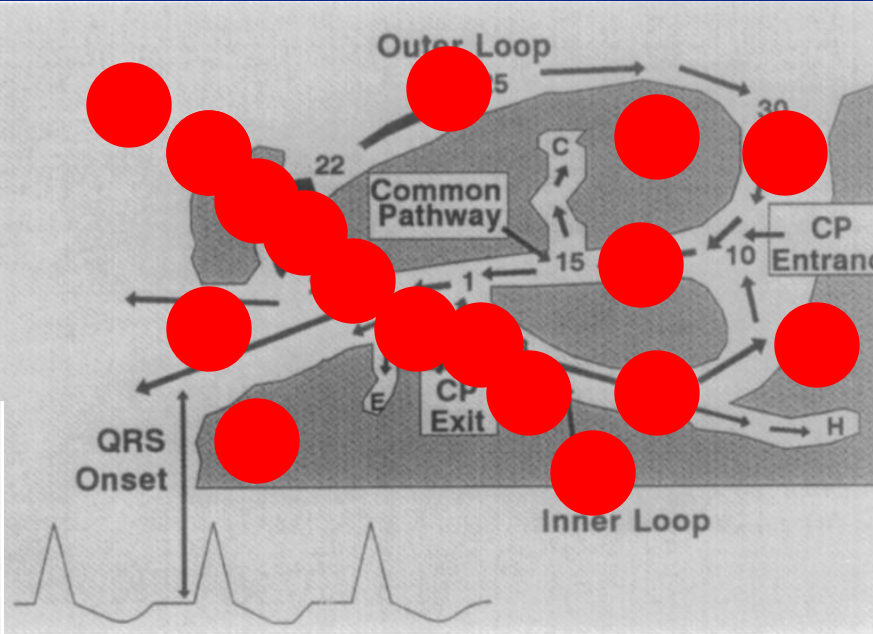
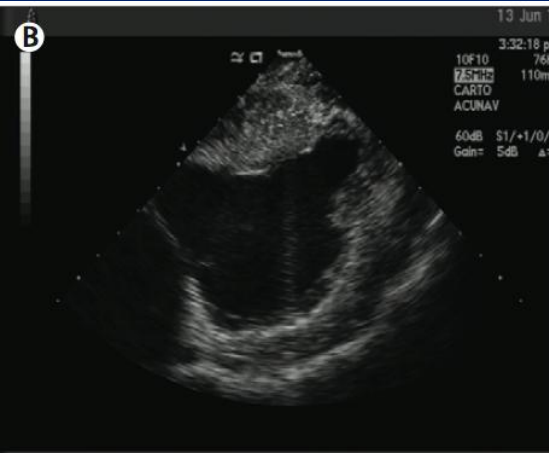
1. for monomorphic VT that is causing severe symptoms.
2. for monomorphic VT when antiarrhythmic drugs are not effective, not tolerated, or not desired.
3. for recurrent sustained polymorphic VT and VF (electrical storm) that is refractory to antiarrhythmic therapy when there is a suspected trigger that can be targeted for ablation.

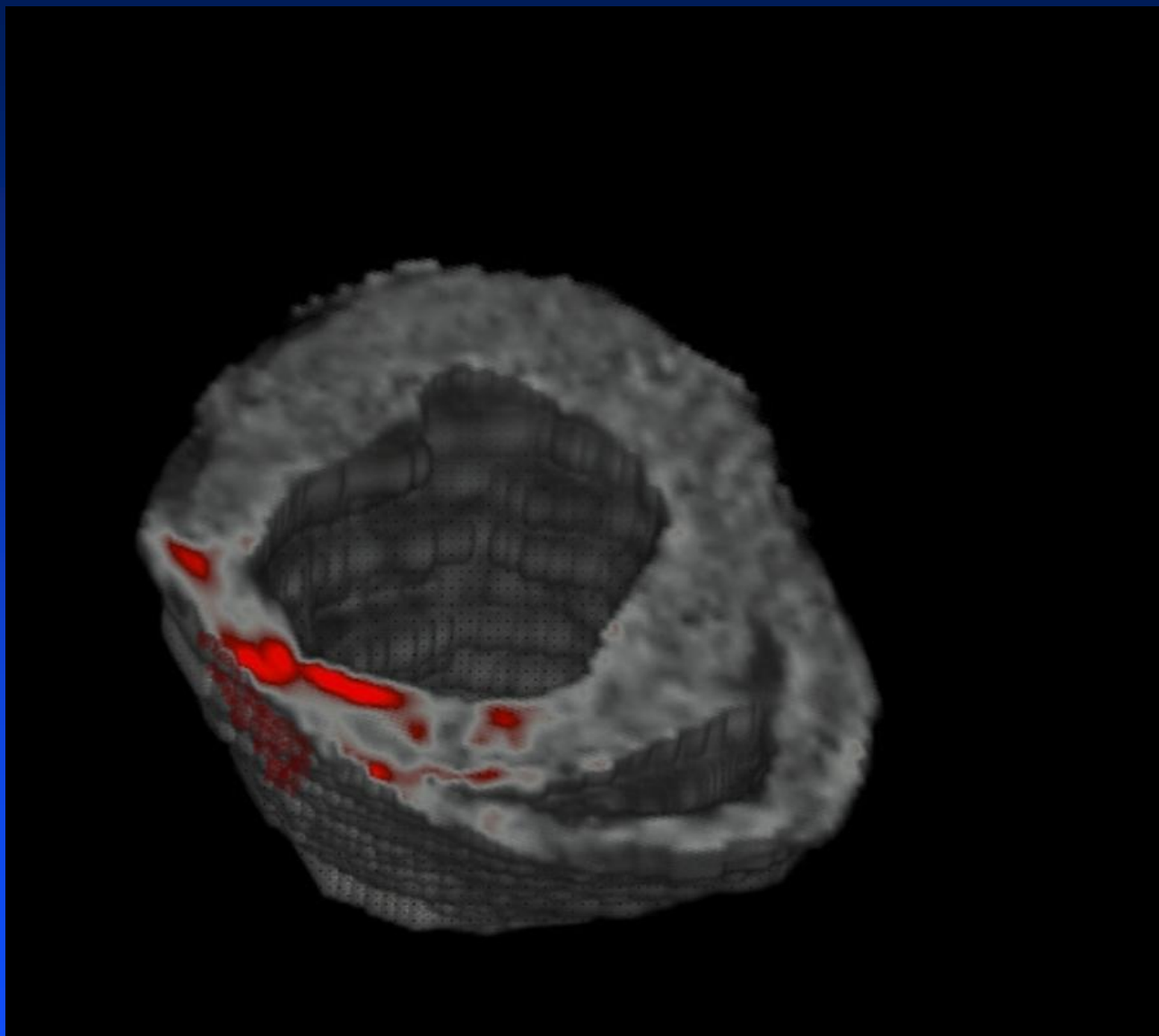
Catheter ablation is recommended for patients with frequent PVCs or NSVTs when they are presumed to cause ventricular dysfunction. At the time of the ablation procedure, the patient should be on antiarrhythmic therapy.

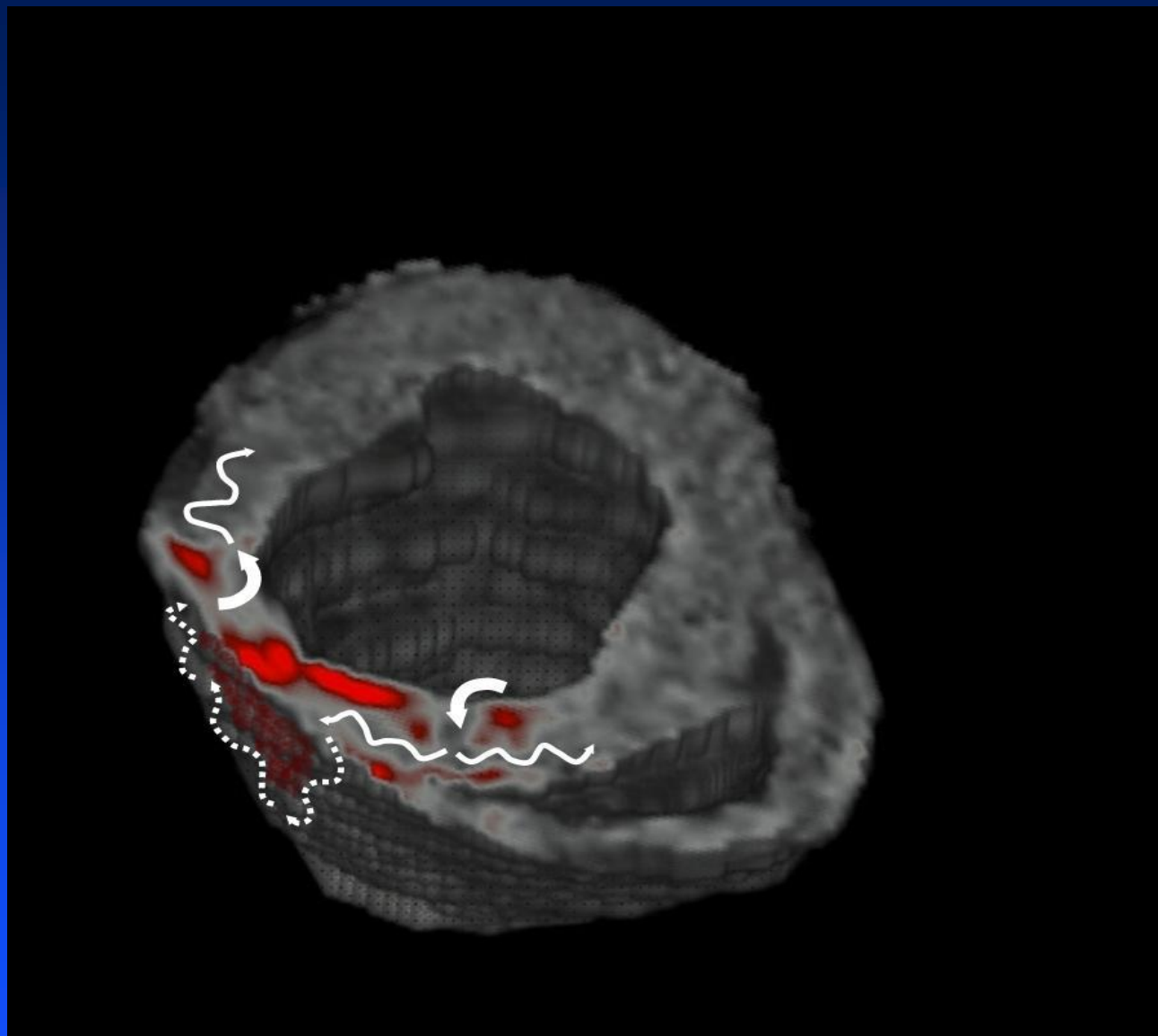
Goals

- Historical Perspective on VT Ablation
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Catheter Ablation Ventricular Tachycardia in Patients with Structural Heart Disease







Outcomes of Catheter Ablation of Ventricular Tachycardia in Patients with Structural Heart Disease

- **Acute Success** **50 – 80 %**
- **Longer Term Efficacy (with AA drugs)** **50%**
- **Major Complications** **5-15%**
- **Clinical Role** **Second line**

Catheter Ablation of Ventricular Tachycardia in Patients With Structural Heart Disease Using Cooled Radiofrequency Energy

Results of a Prospective Multicenter Study

Hugh Calkins, MD, FACC, Andrew Epstein, MD, FACC, Douglas Packer, MD, FACC,
Amelia M. Arria, PhD, John Hummel, MD, FACC, David M. Gilligan, MD, FACC, Janet Trusso, RN,
Mark Carlson, MD, FACC, Richard Luceri, MD, FACC, Harry Kopelman, MD, FACC,
David Wilber, MD, FACC, J. Marcus Wharton, MD, FACC, William Stevenson, MD, FACC, for the
Cooled RF Multi Center Investigators Group*

Baltimore, Maryland

JACC 2000

146 pts, SHD (IHD 82%) , 65 ± 12 yrs, EF $31 \pm 13\%$

Irrigated RF ablation

3 VTs per patient

Acute success in 75% mappable, 41% all VTs

Major compl: 8% (death in 2.7%)

Amiodarone at discharge in 42%

46% recurrence rate during 243 + 153 d fu

25% mortality at one year follow-up

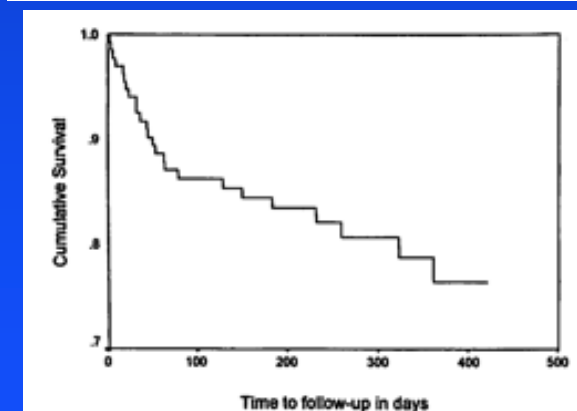
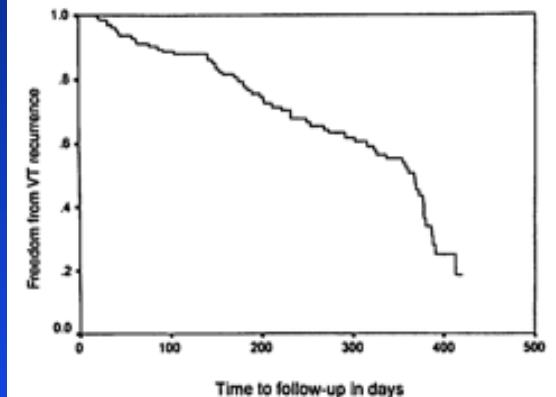


Figure 4. Kaplan-Meier curve showing patient survival after ablation of VT.

Irrigated Radiofrequency Catheter Ablation Guided by Electroanatomic Mapping for Recurrent Ventricular Tachycardia After Myocardial Infarction

The Multicenter Thermocool Ventricular Tachycardia Ablation Trial

William G. Stevenson, MD; David J. Wilber, MD; Andrea Natale, MD; Warren M. Jackman, MD; Francis E. Marchlinski, MD; Timothy Talbert, MD; Mario D. Gonzalez, MD; Seth J. Worley, MD; Emile G. Daoud, MD; Chun Hwang, MD; Claudio Schuger, MD; Thomas E. Bump, MD; Mohammad Jazayeri, MD; Gery F. Tomassoni, MD; Harry A. Kopelman, MD; Kyoko Soejima, MD; Hiroshi Nakagawa, MD;
for the Multicenter Thermocool VT Ablation Trial Investigators

Circ 2008

231 pts, IHD, 68 yrs, EF 25 %
Irrigated RF ablation
3 VTs per patient
Acute success in 49%
Major compl:
Major complications 10.3
Death within 7 days -7 pts (3%)
AA drugs at last fu in 72%
47% recurrence rate at 6 m fu
18% 1 year mortality

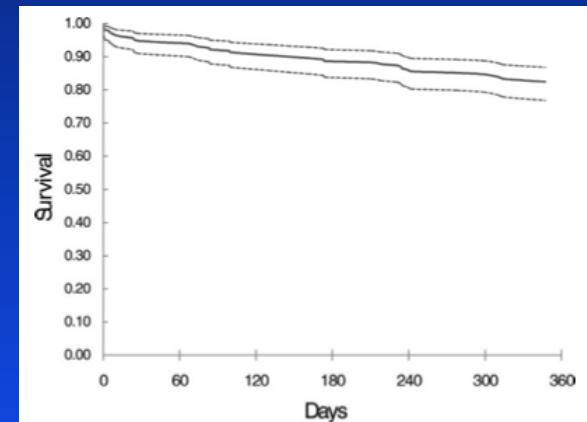


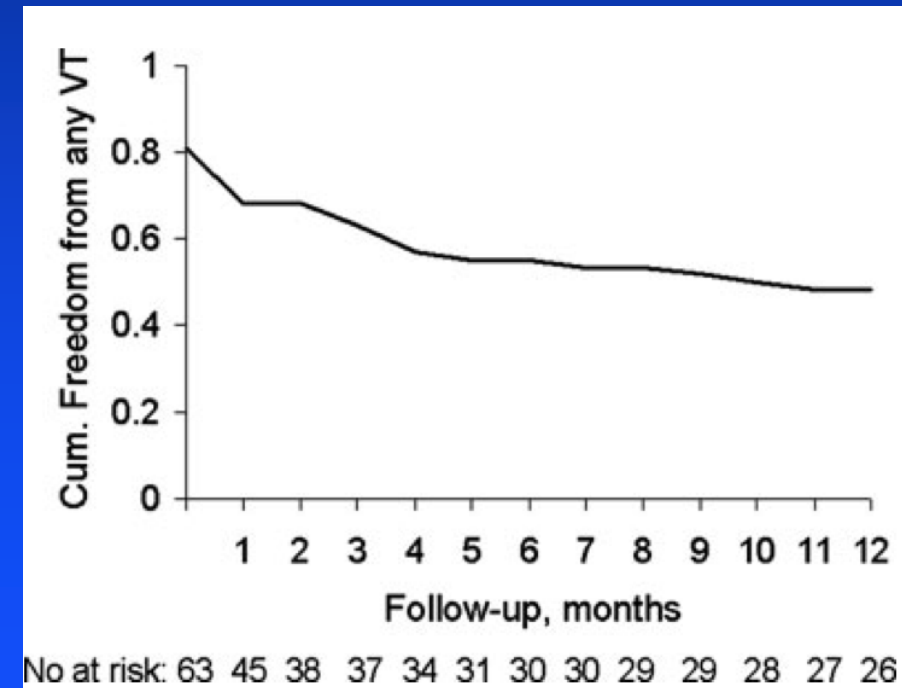
Table 4. Causes of Death

	n	%
Total deaths	40	
Cardiac death	32	80.0
Procedure death <7 d after procedure	7	17.5
Late in-hospital arrhythmia	3	7.5
Out-of-hospital cardiac arrest	5	12.5
Heart failure	14	35.0
Other cardiac (postsurgery, MI)	3	7.5
Noncardiac death (pneumonia, n=2; cancer, n=2)	4	10.0
Unknown cause	4	10.0

Catheter Ablation of Recurrent Scar-Related Ventricular Tachycardia Using Electroanatomical Mapping and Irrigated Ablation Technology: Results of the Prospective Multicenter Euro-VT-Study

HILDEGARD TANNER, M.D.,* GERHARD HINDRICKS, M.D.,* MARIUS VOLKMER, M.D.,†
STEVE FURNISS, M.D.,‡ VOLKER KÜHLKAMP, M.D.,§ DOMINIQUE LACROIX, M.D., PH.D.,¶
CHRISTIAN DE CHILLOU, M.D., PH.D.,# JESÚS ALMENDRAL, M.D., PH.D.,**
DOMENICO CAPONI, M.D.,†† KARL-HEINZ KUCK, M.D.,† and HANS KOTTKAMP, M.D.*

63 pts, IHD, 64 ± 9 yrs, EF $30 \pm 13\%$
Irrigated RF ablation
3 VTs per patient
Acute success in 81%
Major compl: 1.5%
Amiodarone in 65%
49% recurrence rate during 12 + 3 m fu



EHRA/HRS Expert Consensus on Catheter Ablation of Ventricular Arrhythmias

Developed in a partnership with the European Heart Rhythm Association (EHRA), a Registered Branch of the European Society of Cardiology (ESC), and the Heart Rhythm Society (HRS); in collaboration with the American College of Cardiology (ACC) and the American Heart Association (AHA)

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Richard Schilling, MD,¹⁸ Kyoko Soejima, MD,¹⁹ and David Wilber, MD²⁰

Patients with structural heart disease (including prior MI, dilated cardiomyopathy, ARVC/D)

Catheter ablation of VT is recommended

1. for symptomatic sustained monomorphic VT (SMVT), including VT terminated by an ICD, that recurs despite antiarrhythmic drug therapy or when antiarrhythmic drugs are not tolerated or not desired;*
2. for control of incessant SMVT or VT storm that is not due to a transient reversible cause;
3. for patients with frequent PVCs, NSVTs, or VT that is presumed to cause ventricular dysfunction;
4. for bundle branch reentrant or interfascicular VTs;
5. for recurrent sustained polymorphic VT and VF that is refractory to antiarrhythmic therapy when there is a suspected trigger that can be targeted for ablation.

Catheter ablation should be considered

1. in patients who have one or more episodes of SMVT despite therapy with one of more Class I or III antiarrhythmic drugs;*
2. in patients with recurrent SMVT due to prior MI who have LV ejection fraction >0.30 and expectation for 1 year of survival, and is an acceptable alternative to amiodarone therapy;*
3. in patients with haemodynamically tolerated SMVT due to prior MI who have reasonably preserved LV ejection fraction (>0.35) even if they have not failed antiarrhythmic drug therapy.*

Ongoing Multicenter Trials of VT Ablation

- Current Status -

- **Mantra VT: IHD VT randomized to abl or AA drugs**
- **Star VT - clin or induc VT undergoing ICD implant, IHD and NIHD, Abl vs dugs**
- **Aspire VT – IHD VT randomized to early VT abl & drugs versus drugs – closed due to poor enrollment**
- **Vanish - VT abl in IHD pts with VT despite AA drugs randomized to more AA drugs or CA and drugs – enrollment complete**

Ongoing Multicenter Trials of VT Ablation

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- **Mantra VT: IHD VT randomized to abl or AA drugs**
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- **Vanish - VT abl in IHD pts with VT despite AA drugs randomized to more AA drugs or CA and drugs – enrollment complete**

Logistical Challenges that Impair VT Ablation

- Patients present at inconvenient times
- Procedure rooms are full due to the success of AF ablation !
- The numbers of patients are relatively small
- The days of VT arising from large aneurysms are over
- The substrates and extent of disease differ markedly
- Multiple mechanisms for VT often exist (i.e. ischemia)
- VT ablation is technically challenging
- The lesions we can create with RF energy may not be large enough.
- Cases are long
- Risks are high
- Not a money maker
- Amiodarone is widely available

Summary and Conclusion

Catheter ablation of idiopathic VT is a safe, effective, and curative procedure.

Catheter ablation of VT in the setting of structural heart disease is challenging. This is a complex procedure associated with moderate efficacy despite continued AA drug therapy in most patients, and a significant incidence of complications including mortality.

Despite these challenges, this procedure plays an Important role in patient management and represents the true “frontier” of catheter ablation in 2015.

Thank You