ADVANCES IN CATHETER ABLATION OF VT

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UCLA Interventional CV Programs
UCLA Health System
David Geffen School of Medicine at UCLA
Acknowledgements

• American Heart Association
• NIH
• NIH-(Bio Engineering Research Partnership)

DISCLOSURES:
University of California (UCLA campus) Patents: catheter technology, embolism prevention technology, minimally invasive methods for cardiac interventions
52 year old female with monomorphic PVC’s and cardiomyopathy but no evidence of scar on ceMRI

22 year old college student resuscitated from sudden death with monomorphic PVC’s

62 year old male post MI EF of 30% with syncope & VT storm

32 year old male with ‘ARVC’ (previous failed ablation) presents with incessant VT (multiple morphologies)-received 160 shocks (ICD-battery exhausted-skin burns)-intubated sedated-unstable death is imminent
52 yr old female with MMVT that is drug refractory with low EF
UCLA Cardiac Arrhythmia Center: Outflow VT Ablation Playbook: 14 sampling sites

RVOT 1: post
RVOT 2: Ant
RVOT 3: Lat
RVOT 4: septal
RVOT 5: above pulmonic V

RAO
LAO
Mapping and Locating the Source
A NEUROINTERVENTIONAL INVENTION USED IN CARDIOLOGY!
INTRA-SEPTAL VT: MAPPING AND ABLATION

ECGI: Surface ECG combines with CT imaging to produce 3D maps of electrical activity on the surface of the human heart.

Cardiac Isochrone Positioning System CIPS
CASE PRESENTATIONS

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Cardiac events (syncope, cardiac arrest, PMVT) were more common in the SOV/GCV vs the RV/LV group (7/27 [26%] vs 2/46 [4%], p<0.02)

Bradfield J, Homsi M, Shivkumar K and Miller JM: Coupling Interval Variability Differentiates Ventricular Ectopic Complexes Arising In The Aortic Sinus Of Valsalva And Great Cardiac Vein From Other Sources: Mechanistic And Arrhythmic Risk Implications. JACC 2014;63:2151-2158
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SCHEMATIC OF VENTRICULAR TACHYCARDIA DUE TO A SCAR

SCARS AND BORDER ZONES ARE COMPLEX! THE BAR FOR IMAGING


UCLA PROTOCOL FOR SUBSTRATE BASED AND ACTIVATION BASED MAPPING STRATEGIES FOR CATHETER ABLATION OF VENTRICULAR TACHYCARDIA

- Electroanatomic scar mapping in sinus rhythm
  - VT induction (NIPS if ICD present)
    - Stable VT
      - Entrainment mapping
      - Mapping of fractionated diastolic activity
      - PMI and no diastolic activity apparent
    - Noninducible
    - Unstable VT
      - Tagging of abnormal EGMs
        - Late potentials
          - Split/fractionated EGMs
      - +Late potentials present
        - Pace mapping of abnormal EGMs
      - -Late potentials absent
        - Encircling border zone ablation
        - Ablation of abnormal EGMs with MES, pacemap matches with targeted linear ablation of proximate border zone
      - Ablation of all remaining late activity to homogenize scar

ELECTRICAL HOMOGENIZATION OF VENTRICULAR SCAR BY
CATHETER-BASED DELIVERY OF COLLAGENASE

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VT patient presentation:
Medical and ICD management

Catheter Ablation of VT

Post-ablation management

Discharge and follow-up care

Cardiac Electrophysiology

VT-VF STORM - CLINICAL COURSE

Use of thoracic epidural anesthesia for management of electrical storm: A case report

Aman Mahajan, MD PhD,*† James Moore, MD, † David A. Cesario, MD, PhD,*
Kalyanam Shivkumar, MD, PhD*

*From UCLA Cardiac Arrhythmia Center, Department of Medicine, Division of Cardiology, Los Angeles, California, and
†Department of Anesthesiology, David Geffen School of Medicine at UCLA, Los Angeles, California.

Thoracic Epidural Delivery of 0.25% Bupivacaine at T1-T2 Interspace: Fluoroscopic view of contrast injected via epidural catheter

Heart Rhythm 2005; (2)12:1359-1362
EDITORIAL COMMENTARY

Antiarrhythmic effects of targeted cardiac neuromodulation: Is it time for clinical application?

Ziad F. Issa, MD,* Douglas P. Zipes, MD†

ACC/AHA/ESC Practice Guidelines

ACC/AHA/ESC 2006 Guidelines for Management of Patients With Ventricular Arrhythmias and the Prevention of Sudden Cardiac Death
A Report of the American College of Cardiology/American Heart Association Task Force and the European Society of Cardiology Committee for Practice Guidelines (Writing Committee to Develop Guidelines for Management of Patients With Ventricular Arrhythmias and the Prevention of Sudden Cardiac Death)

Developed in Collaboration With the European Heart Rhythm Association and the Heart Rhythm Society
**VALUE OF PET IMAGING: ‘CARDIAC INFLAMMATION’**

**Localized inflammation**

- **Early stage AIC**
  - PET-CT
  - Perfusion: normal
  - FDG Metabolism

- **Late stage AIC**
  - PET-CT
  - Perfusion: defect
  - FDG Metabolism: mismatch
  - Peritracheal/hilar uptake

**Systemic inflammation**

- **Early stage AIC+**
  - PET-CT
  - Perfusion: normal
  - FDG Metabolism
  - Hilar uptake

- **Late stage AIC+**
  - PET-CT
  - Perfusion: defect
  - FDG Metabolism: mismatch

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Post-Steroid therapy x 8 wks

LIMITS OF CURRENT CATHETER BASED THERAPY OF THE SUBSTRATE

• MMVT Circuits Are Deep Within Scar: ICM > NICM

• Scar Border Zones Are Critical: NICM ±

• Late potentials an ‘electrical footprint’: ICM > NICM

• Clinical Imaging Is Providing New Insights

• Mapping Techniques Have Greatly Improved

• Epicardial vs Endocardial Scar: NICM > ICM

• Interplay Between Structural VT And Functional Components: NICM possibly > ICM
WHERE TO NEXT? A ‘HIGHER’ LEVEL-THE NEURAXIS

FOCAL VF

MACRO REENTRY

FUNCTIONAL ARRHYTHMIAS/HEART FAILURE
Neuraxial Modulation for Refractory Ventricular Arrhythmias
Value of Thoracic Epidural Anesthesia and Surgical Left Cardiac Sympathetic Denervation

Tara Bourke, MD; Marmar Vaseghi, MD; Yoav Michowitz, MD; Vineet Sankhla, MD; Mandar Shah, MD; Nalla Swapna, MD; Noel G. Boyle, MD, PhD; Aman Mahajan, MD, PhD; Calambur Narasimhan, MD, DM; Yash Lokhandwala, MD, DM; Kalyanam Shivkumar, MD, PhD


Anatomy and histology of left sympathetic chain

Cardiac Sympathectomy for VT & VF Intermediate and Long Term Follow-Up: North American (UCLA) Series


STRUCTURE - FUNCTION INTERPLAY AND SCD

Higher Centers

Cervico-thoracic spinal cord

Afferent signals

Scar and denervation

Cytokines

NGF

Myocardial infarction

Efferent signals

Cytokines

NGF

Heterogenous substrate

Stellate ganglion remodelling

↑Sympathetic activation

→

EADs

DADs

↑Dispersion of repolarization

VT/VF

Normal cell

Nerve sprouts

Scar
Autonomic Control!

Bodh Gaya, India