# HEALTHY HEART

VOLUME-11 | ISSUE-127| JUNE 05, 2020

**Honorary Editor :**

Dr. Hiren Kevadiya

Dr. Ajay Naik

Ventricular tachycardia (VT) is a life-threatening arrhythmia that is common to all forms of heart disease and an important cause of sudden death, but also has less catastrophic presentations, including syncope and palpitations, that are sometimes harbingers of a future fatal event. Ventricular scars from infarction or replacement fibrosis provide a substrate for re-entry that is a common cause. Understanding the pathophysiologic link between ventricular scars and ventricular tachycardia informs approaches to identify patients at risk, has led to development of methods to ablate the arrhythmia substrate, and suggests future diagnostic and therapeutic strategies. Despite implantable defibrillators (ICDs), which provide protection from sudden death, recurrent VT predicts increased risk of mortality and negatively affects quality of life. Use of systematic approach in 3D mapping and advanced catheters has been shown to improve VT ablation outcomes in recent trials. There have been continued advancements in mapping technologies and techniques allowing for better definition of potential targets for catheter ablation. Catheter VT ablation has shifted to a potential early line of therapy for scar VT which will improve the patient's quality of life.

## SCAR RELATED VENTRICULAR TACHYCARDIA (SCAR VT)

### INTRODUCTION

Ventricular tachycardia (VT) and ventricular fibrillation (VF) are important and significant causes of morbidity and sudden cardiac death (SCD) in patients with structural and ischemic heart disease. Implantable cardioverter defibrillators (ICD) have been able to reduce mortality and morbidity from VT or VF. However, recurrent VT and ICD shocks are associated with increase in morbidity and mortality.

Antiarrhythmic drugs (AADs) are used frequently in the treatment of VT. However, AADs are associated with significant risks of proarrhythmia and side effects. With continued evolution of ablation techniques and technologies, catheter ablation for VT is becoming an increasing standard in the management of VT and VF.

### INCIDENCE AND PREVALENCE

The incidence of ventricular arrhythmias and sudden deaths was estimated to account for 5.6% of all mortality, claiming 350,000 to 400,000 lives annually in the United States. The risk of SCD is highest in patients with structural heart disease, and underlying coronary artery disease. The risk of SCD following MI appears to be greatest in the first 30 days after MI, and declines and plateau after 12 months. However, the risk of sudden death remains elevated and is significantly higher in those with ventricular dysfunction (left ventricular EF <35%). Non-ischemic dilated cardiomyopathy and Infiltrative cardiomyopathy especially sarcoidosis are also associated with scar related VT.

### ARRHYTHMOGENIC SUBSTRATE

- Ischemic Cardiomyopathy
- Non-Ischemic Dilated Cardiomyopathy
- Hypertrophic Cardiomyopathy
- Infiltrative Cardiomyopathy (Sarcoidosis, Tuberculosis, etc.)
- Genetic mutations (Arrhythmogenic RV Cardiomyopathy – ARVC)
- Post-surgical repair of congenital heart diseases

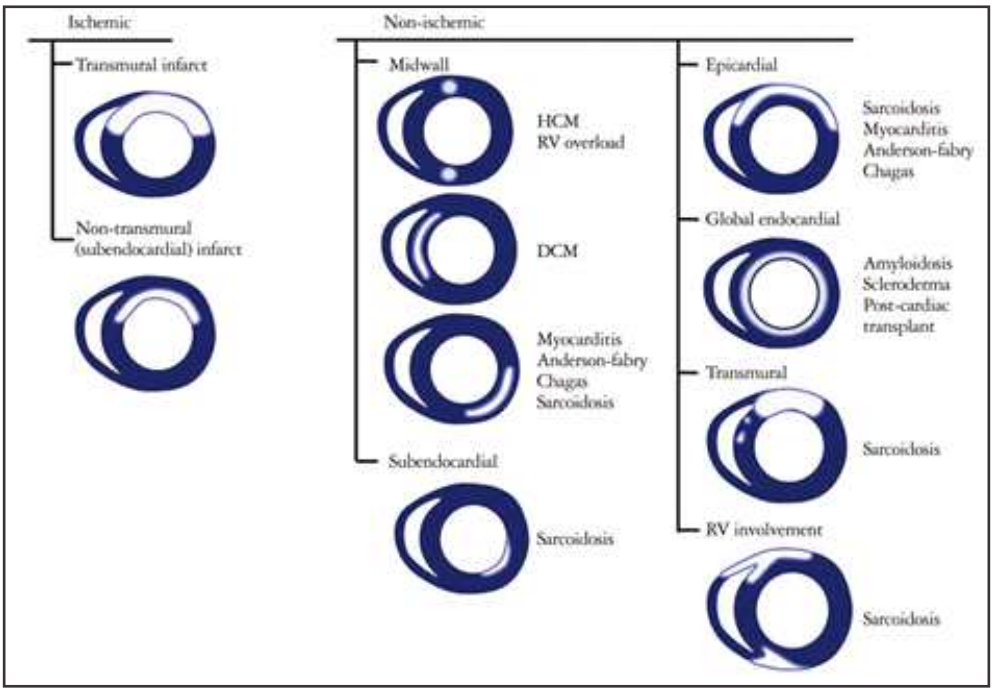



**Figure 1: Location of Arrhythmogenic substrate (myocardial scar) in various diseases assessed by cardiac MRI**

## ISCHEMIC CARDIOMYOPATHY

The majority of VT in ischemic cardiomyopathy is due to re-entry associated with myocardial scar (Figure 2). The arrhythmogenic substrate appears to develop within weeks after the initial infarction and persists afterward.

VT associated with MI often originated from the subendocardial region of the infarcted myocardium. Some of the myocardial fibers in infarcted region may survive and this fibers become interspersed in fibrotic scar that is characterized by slowed and nonuniform conduction (Figure 3). These slow conduction areas appear in the infarcted tissue with a "zigzag" course through the myocardium (Figure 4). Re-entry through these surviving myocardial fibers is primarily on the subendocardium, but can occur in the midmyocardium and also the epicardium.

Most patients with VT after MI (60%–80%) often have multiple morphologies of VT. The re-entrant circuits associated with different VT morphologies are commonly within the same region (Figure 5). VTs may rotate in different directions along the isthmus, with variable extent of central line of block.

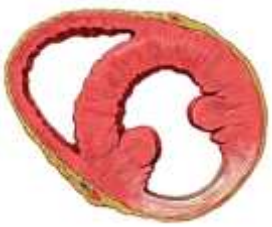


**Fig. 2. Scarred Inferior wall in Old Myocardial infarction**

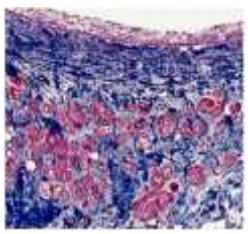


**Fig. 3. Surviving myocardial fibers/channels in Scar region**

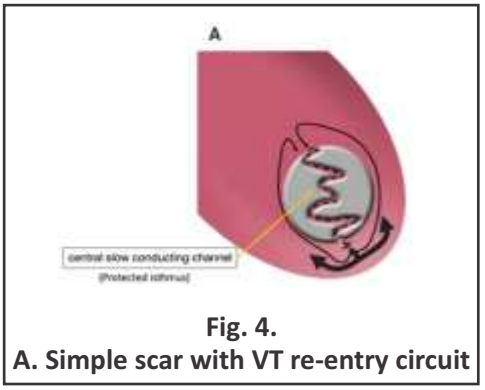



**Fig. 4.**
**A. Simple scar with VT re-entry circuit**

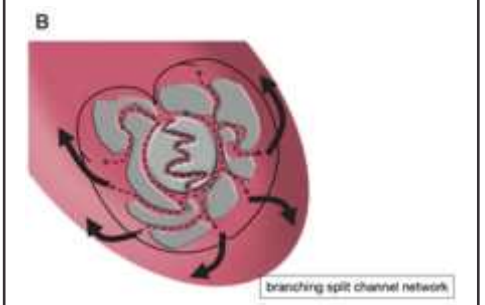



**Fig. 4.**
**B. Complex scar with VT re-entry circuit**

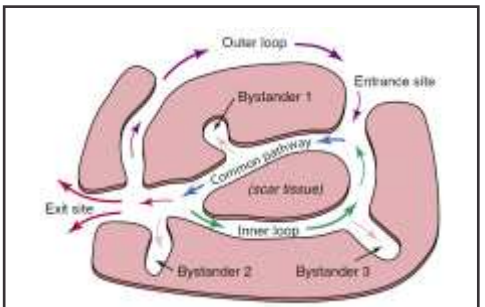



**Fig. 5. Electrical Circuit in Scar related Ventricular Tachycardia (Scar VT)**

## NON-ISCHEMIC DILATED CARDIOMYOPATHY

Non-ischemic dilated cardiomyopathy is a term used for a mixed group of disease processes that often involve the intra-myocardium and epicardium. Cardiac MRI is a powerful tool that can identify substrate and sites critical to the maintenance of ventricular tachycardia. 3D Electroanatomical mapping (3D EAM) also helps in identifying arrhythmogenic substrate (myocardial scar) (Figure 6)

HEALTHY HEART
VOLUME-11 | ISSUE-127| JUNE 05, 2020

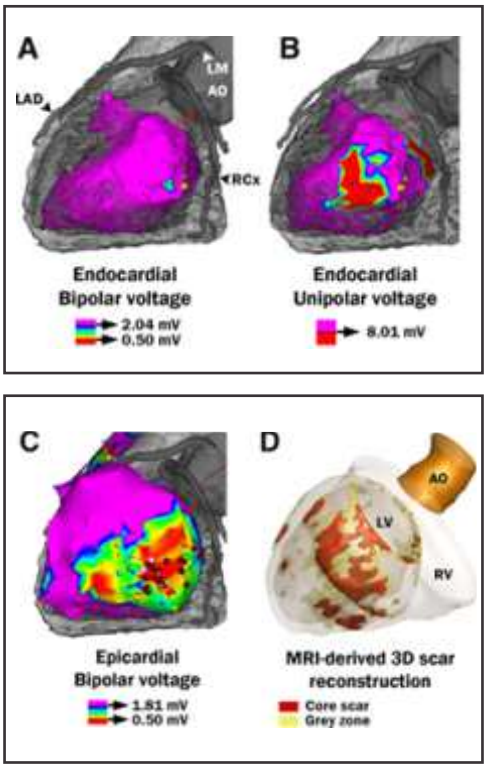



**Figure 6: Myocardial scar (Arrhythmic Substrate) identification in Non-ischemic Dilated Cardiomyopathy by 3D Mapping**

## HYPERTROPHIC CARDIOMYOPATHY

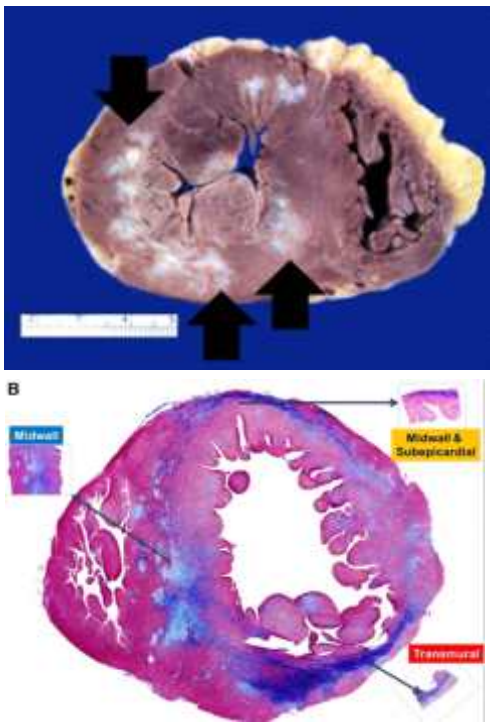



**Figure 7: Arrhythmogenic substrate (myocardial scar) in Hypertrophic Cardiomyopathy**

## INFILTRATIVE CARDIOMYOPATHY (SARCOIDOSIS, TUBERCULOSIS)

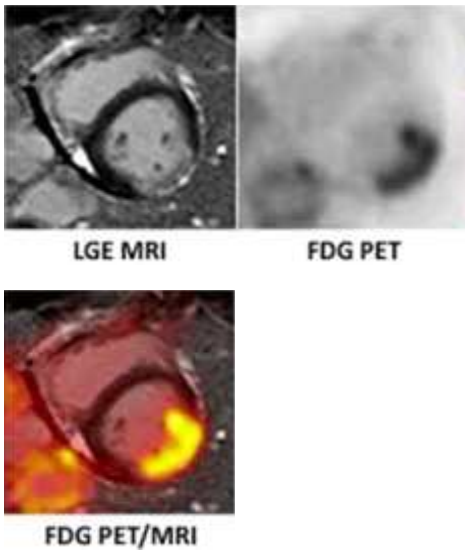



**Figure 8:**
Arrhythmia substrate in Sarcoidosis

## GENETIC MUTATIONS (ARRHYTH MIGENIC RV CARDIOMYOPATHY)

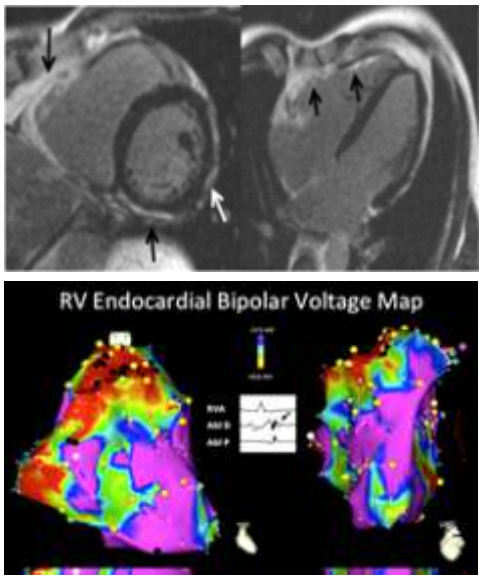



**Figure 9:** Arrhythmia substrate (myocardial scar) in ARVC (Cardiac MRI, 3D Mapping)

## POST-SURGICAL REPAIR OF CONGENITAL HEART DISEASES

Slow conducting myocardial tissue bordered by surgical scars, prosthetic material, and valve annuli are the dominant substrate for VT in repaired congenital heart disease (Figure 10). Identification and transection of these anatomic isthmuses by catheter ablation leads to long-term VT-free survival in patients with repaired CHD and preserved biventricular function.

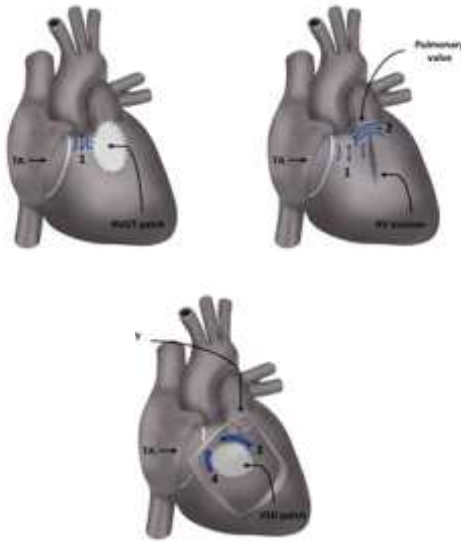


**Figure 10: Arrhythmias substrate in Post-surgical repair of TOF**

## MANAGEMENT OF SCAR RELATED VENTRICULAR TACHYCARDIA

- Medical Management (Anti-arrhythmic drugs)
- AICD or CRT-D implantation (Secondary Prophylaxis against VT/VF)
- 3D Mapping & RF ablation

## 3D MAPPING & RF ABLATION OF SCAR RELATED VT

### Why 3D Mapping?

Antiarrhythmic drugs (AADs) are used frequently in the treatment of VT but are associated with significant risks of proarrhythmia and side effects. Recurrent VT and ICD shocks are associated with increase in morbidity

and mortality. So, With continued evolution of ablation techniques and technologies, 3D Mapping & catheter ablation for scar related VT is becoming a standard of care.

## 2D Mapping vs 3D Mapping?

Conventional 2D mapping assess the timing of electrical activation at various locations in the heart (endocardial, epicardial, or both) under fluoroscopic guidance.

Better understanding and definition of the patient's cardiac anatomy and identification of anatomic structures vital for initiation and maintenance of cardiac arrhythmias will increases the chances of successful electro-physiological procedures.

2D Fluoroscopy system cannot reproduce the three-dimensional heart structure. 2D catheter mapping to determine the activation patterns is cumbersome, and exposure to ionizing radiation is often high. This is compounded further by the lack of accurate reproducibility of intra-cardiac catheter localization by x-ray projection alone.

## Why 3D Mapping is better than Conventional 2D Mapping in Scar related VT?

3D electroanatomic mapping techniques Utilize specialized catheters and patches to determine position within the heart. This positional information is combined with electrical timing data to provide a map of the cardiac chamber of interest in these computer-based mapping systems. Computer generated 3D-representation of data using electroanatomical mapping can objectively reinforce a physician's subjective interpretations. 3D Mapping facilitates the mapping of the complex arrhythmias. Reduces radiation exposure while potentially reducing the procedure duration and risk.

3D Mapping helps recreate cardiac anatomy, evaluate electrical activation during arrhythmias, allow real-time catheter localization and guide catheter placement for delivery of RF current.

3D Mapping assists in identifying sites of early activation for focal arrhythmias and appears to be useful in identifying critical isthmuses in complex reentry circuits.

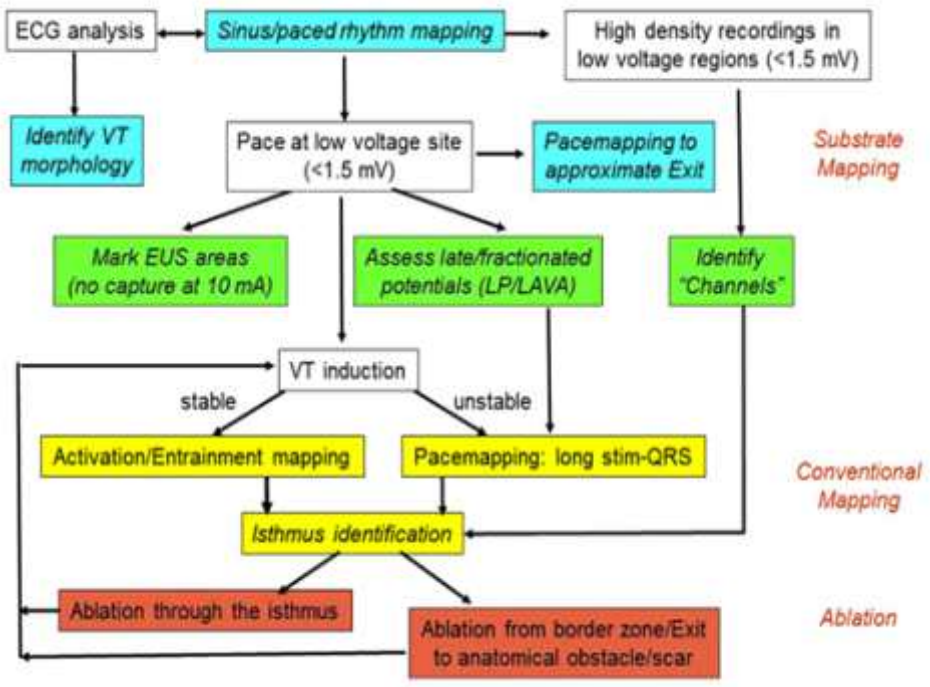
3D constructs of electrogram voltage may also help define areas of electrical scarring and infarction. Voltage, local activation timing and complex fractionated electrogram maps to demonstrate the complex relation between the anatomical and functional barriers in the complex arrhythmias.

Scar-related VT and postoperative arrhythmias with complex re-entrant circuits can be treated more effectively with 3D Mapping system.

## Results of 3D Mapping & RF ablation in Scar related Ventricular Tachycardia (Scar VT)

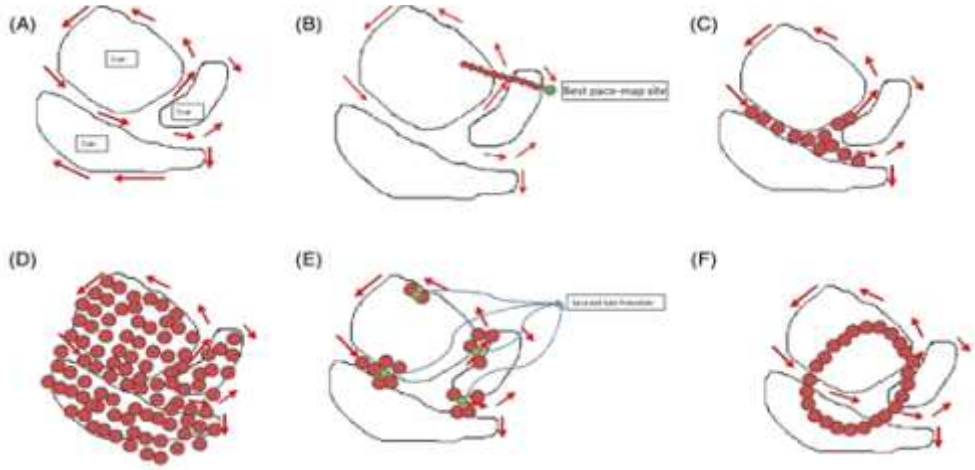
3D Mapping & RF catheter ablation is an effective treatment for drug-refractory scar related ventricular tachycardias (VTs) in patients structural heart diseases. Use of systematic approach in 3D mapping and advanced catheters and the advent of percutaneous epicardial ablation have improved the overall success rates of these procedures (Figure 11, 12).

## Systemic approach in the strategies of 3D mapping and ablation for scar VT (Figure 11)



HEALTHY HEART
VOLUME-11 | ISSUE-127| JUNE 05, 2020

**Figure 12 :Common strategies of scar ventricular tachycardia (scar VT) ablation**




A, Schematic representation of a VT substrate. Areas of dense scar containing channels of surviving fibers forming possible VT isthmuses of re-entrant VT circuits.

B, Linear ablation lesions extended perpendicular from the border zone to the area of dense scar.

C, Scar de-channelling.

D, Scar homogenization.

E, Ablation of local abnormal ventricular activity (LAVA) and late potentials (LPs).

F, Core isolation

**Figure 13: 3D Mapping in Ischemic Cardiomyopathy (CARTO) (Case example)**

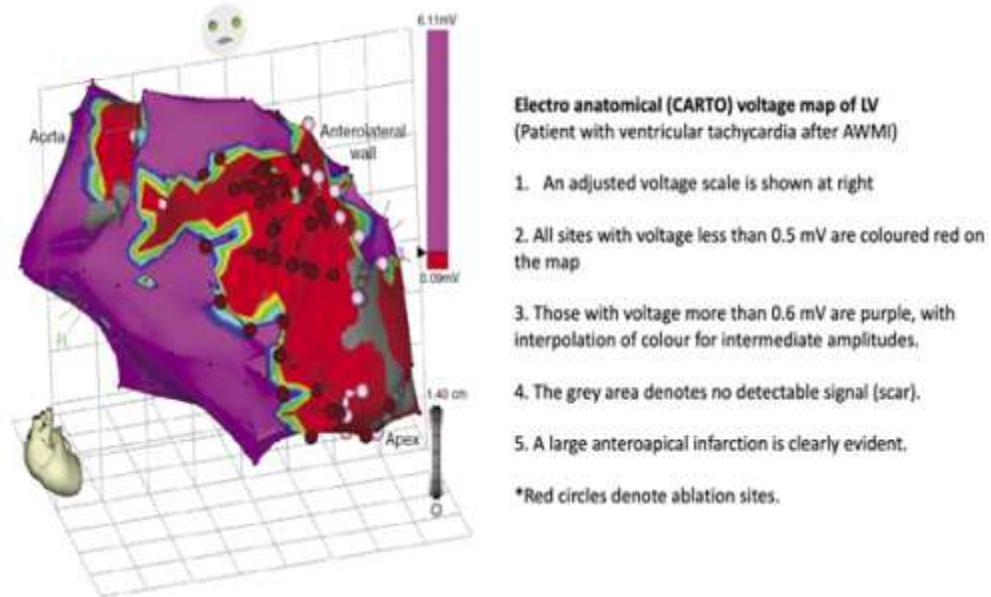
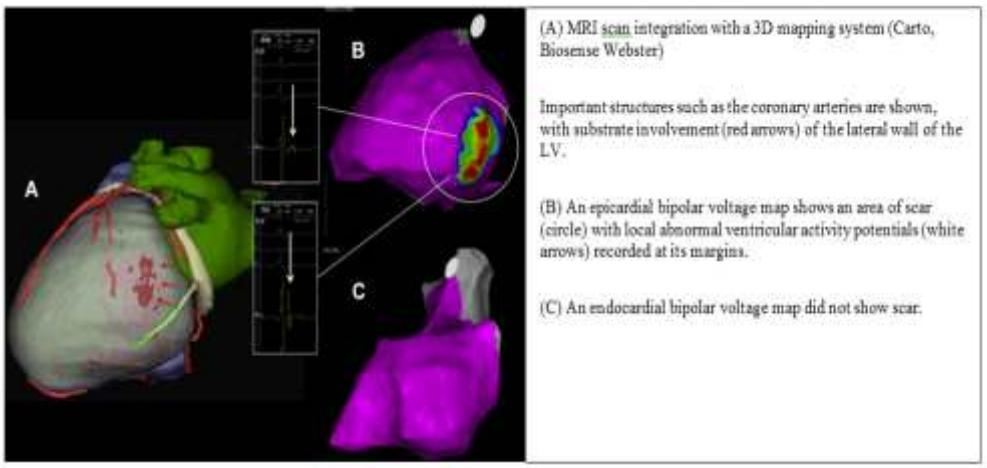



**Figure 14: 3D Mapping in Dilated Cardiomyopathy (CARTO MRI MERGE) (Case Example)**




## TAKE HOME MESSAGE

Scar related Ventricular arrhythmias (VT/VF) arise from a complex myocardial scar (Arrhythmic substrate) and remain a significant cause of morbidity and mortality in patients with structural heart diseases. Toxicity of anti-arrhythmic drugs and recurrent ICD shocks make 3D Mapping and RF ablation as one of the best treatment option for such recurrent arrhythmias. Use of systematic approach in 3D mapping and advanced catheters has been shown to improve VT ablation outcomes in recent trials. There have been continued advancements in mapping technologies and techniques allowing for better definition of potential targets for catheter ablation. Catheter VT ablation has shifted to a potential early line of therapy which will improve the patient's quality of life.

**Dr. Hiren Kevadiya**
MBBS, MD Medicine, DM Cardiology
(Sree Chitra, Trivandrum)
Fellow in Pacing & Cardiac Electrophysiology
(Sree Chitra, Trivandrum)
Associate Member - Indian Heart Rhythm Society
Member - Asia Pacific Heart Rhythm Society
Interventional Cardiac Electrophysiologist
Specialist in Cardiac Arrhythmias & Heart Failure

# We are COVID and Corona Safe.
# "CIMS EAST" HOSPITAL (Non-COVID Hospital)

## SEPARATE BUILDING


## ADMISSION AND OPD OPEN

UNIQUE DOUBLE BUILDING FACILITY
SEPARATE CANCER / RADIOTHERAPY CENTRE

## SEPARATE ENTRY

## SEPARATE STAFF

**SEPARATE UNIQUE**
**20 BED AREA**
**for SUSPECT-NON COVID ADMISSIONS**

## SEPARATE EMERGENCY ROOM

"CIMS EAST" HOSPITAL

**500,000 square** feet
**Two seperate** buildings on **3.5 acres land**

## WE ARE OPERATING

BEST PATIENT SAFETY PROTOCOLS
PROPER PERSONAL PROTECTIVE EQUIPMENT (PPEs)

CIMS®
CARE INSTITUTE OF MEDICAL SCIENCES
Earning Trust with World-Class Practices

HEALTHY HEART
VOLUME-11 | ISSUE-127| JUNE 05, 2020

We are COVID and Corona Safe.

# "CIMS EAST" HOSPITAL (Non-COVID Hospital)

## ALL ARE WORRIED DURING COVID-19

## BUT DO NOT IGNORE THESE SYMPTOMS

**GET CARE FAST**

**In case of following symptoms please rush to your nearby hospital**

**24 X 7**

**MEDICAL HELPLINE**
**+91-70 69 00 00 00**

### HEART ATTACK SYMPTOMS

- Chest pain or pressure
- Tightness, burning or heaviness in the chest
- Shortness of breath
- Profuse sweating
- Nausea and vomiting

### STROKE SYMPTOMS

**F**ace
Face look uneven ?

**A**rm
One arm hanging down ?

**S**peech
Slurred speech ?

**T**ime
Call 108 Now

HEALTHY HEART
VOLUME-11 | ISSUE-127| JUNE 05, 2020

CIMS®
CARE INSTITUTE OF MEDICAL SCIENCES
Earning Trust with World-Class Practices

**Healthy Heart Registered under RNI No. GUJENG/2008/28043**
**Published on 5th of every month**
**Permitted to post at PSO, Ahmedabad-380002 on the 12th to 17th of every month under**
**Postal Registration No. GAMC-1725/2018-2020 issued by SSP Ahmedabad valid upto 31st December, 2020**
**Licence to Post Without Prepayment No. PMG/HQ/055/2018-20 valid upto 31st December, 2020**

**If undelivered Please Return to :**

CIMS Hospital, Nr. Shukan Mall,

Off Science City Road, Sola, Ahmedabad-380060.

Ph. : +91-79-2771 2771-72

Fax: +91-79-2771 2770

Mobile : +91-98250 66664, 98250 66668

**Subscribe "Healthy Heart" :** Get your "Healthy Heart", the information of the latest medical updates only ₹ 60/- for one year. To subscribe pay ₹ 60/- in cash or cheque/DD at CIMS Hospital Pvt. Ltd. Nr. Shukan Mall, Off Science City Road, Sola, Ahmedabad-380060. Phone : +91-79-4805 1059 / 4805 1060. Cheque/DD should be in the name of : **"CIMS Hospital Pvt. Ltd."** Please provide your **complete postal address with pincode, phone, mobile and email id** along with your subscription



CIMS Hospital : Regd Office: Plot No.67/1, Opp. Panchamrut Bunglows, Nr. Shukan Mall, Off Science City Road, Sola, Ahmedabad - 380060.
Ph. : +91-79-2771 2771-72 Fax: +91-79-2771 2770.
CIMS Hospital Pvt. Ltd. | CIN : U85110GJ2001PTC039962 | info@cims.org | www.cims.org

**Printed, Published and Edited by Dr. Keyur Parikh on behalf of the CIMS Hospital**
**Printed at Hari Om Printery, 15/1, Nagori Estate, Opp. E.S.I. Dispensary, Dudheshwar Road, Ahmedabad-380004.**
**Published from CIMS Hospital, Nr. Shukan Mall, Off Science City Road, Sola, Ahmedabad-380060.**