ORIGINAL ARTICLE

RADIOFREQUENCY ABLATION OF VENTRICULAR TACHYCARDIA IN POST MYOCARDIAL INFARCTION PATIENTS: KUWAIT EXPERIENCE

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Abstract

We evaluated prospectively 5 patients with previous myocardial infarction who had ventricular tachycardia. The objective of this study was to describe the arrhythmogenic areas and ablate the ischemic VT successfully with multiple radiofrequency applications. All patients were considered eligible irrespective of the presence of Automatic implantable cardioverter-defibrillator implants. Coronary artery bypass graft was performed for two patients. One patient had developed ventricular tachycardia/ventricular fibrillation post surgery requiring radiofrequency ablation followed by AICD implantation. Three patients with ischemic cardiomyopathy, who had AICD, developed VT prior to the radio frequency ablation therapy. In 5 patients with ventricular tachyarrhythmias three dimensional mapping was performed using non contact mapping (EnSite). RF ablations targeted the arrhythmogenic areas of infarcted zone. All patients were rendered completely non inducible at the end of the procedure. The mean procedure time measured was 3 hours. No complications were observed in any of those patients. On follow up, all patients improved clinically with regard to the quality of life and number of AICD shocks. One post AICD patient had non sustained ventricular tachycardia, during the follow up period. Conclusion: This is a limited study of our local experience in the successful radio frequency ablation of ischemic ventricular tachycardia. ***Heart Views 2007;8(4):147-152.*** © Gulf Heart Association 2007.

Keywords: ? Ventricular tachycardia Myocardial infarction ? Radiofequency ablation ? Implantable Cardioverter-defibrillator ? Ischemic Cardiomyopathy ? Mapping.

Introduction

Radio frequency ablation is effective therapy for recurrent ventricular tachycardia in patients with prior myocardial infarction who received multiple shocks from AICD. The radiofrequency catheter ablation of VT involves careful endocardial mapping combined with pacing maneuvers to localize the area of scar and precise identification of re-entrant circuit sites[1,3,4]. The identification of the arrhythmogenic substrate during mapping and ablation therapy is difficult and time consuming procedure. A number of criteria for mapping and ablation of ventricular tachycardia have been described[2,4,5]. The electrophysiology study with precise identification of arrhythmogenic substrate and radio frequency ablation of VT in critically ill patients with ischemic heart disease have been described previously[6,7].

Patients and Methods

Radiofrequency ablation has been used for the treatment of ischemic ventricular tachycardia with varying success rates. The study included 5 male post myocardial infarction patients (July 2007 to Nov 2007) and Age range 35 to 76 years. (Table 1) with documented haemodynamically untolerated ventricular tachycardia unresponsive to antiarrhythmic treatment including the full dose of amiodarone. Each patient had the history of one or more than one risk factor (Table 1). They were referred to the heart center for electrophysiological evaluation and were considered eligible for radio frequency ablation procedure. Coronary angiography followed by percutaneous transluminal coronary angioplasty and stent placement to the target vessel was done in three patients. Coronary Artery bypass graft was performed for two patients (Table 1). All patients

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Table 1: Clinical Characteristics

Pt*	Age (Yrs)	Sex	Risk Factor*	VT substrate[0]	Revascularization**	LVEF%***	Clinical Presentation****	AAD*	AICD***** Implan-tation prior to RFCA++
I	76	M	HTN, DM, Dyslipid.	Post MI (Inferoposterior)	PTCA with stent to LCX	30%	AICD discharges due to VT/VF, syncope and acute heart failure	Amiodarone	Yes
II	75	M	HTN, DM, Dyslipid.	Post MI LV aneurysm (Extensive Anterior wall)	PTCA with stent to LMCA	20%	AICD discharges, due to VT, syncope and acute heart failure	Amiodarone	Yes
III	68	M	HTN	Post MI (Anterior and Posterior)	CABG	50%	Syncope and recurrent VT/VF required defibrillation.	Amiodarone	No
IV	35	M	Smoking, HTN	Post MI (Anterior)	PTCA with stent to LAD	20%	Syncope and MVT	Amiodarone	No
V	53	M	Smoking	Post MI. LV aneurysm (anterior)	CABG	20%	AICD discharges due to VT/VF and Syncope	Amiodarone	Yes

Risk Factor* pt# - Patient number HTN – Hypertension – DM Diabetes Mellitus - LVEF%*** – Left Ventricular Ejection Fraction.
VT substrate[0] Post MI – Post Myocardial Infarction Revascularization** PTCA Percutaneous Transluminal Coronary Angioplasty.
LCX Left Circumflex , LMCA-Left Main Coronary Artery , CABG - Coronary Artery Bypass Graft.
LAD – Left Anterior Descending. Clinical Presentation****, AICD***** – Automatic Implantable Cardioverter Defibrillator,
VT/VF – Ventricular Tachycardia/Ventricular Fibrillation. MVT – Monomorphic Ventricular Tachycardia, AAD + Anti Arrhythmic Drugs,
RFCA++ – Radio Frequency Cather Ablation.

were being treated with antiarrhythmic drugs (Table 1).The mean left ventricular ejection fraction was 30%. All patients underwent Automatic implantable cardioverter defibrillator implantation. Three patients had the AICD fixed prior to the procedure (Table 1). All patients were being followed up regularly at the heart center out patient clinic.

Mapping, Ablation strategy and Results

An informed written consent was obtained by all patients prior to the study. Technical details of commercially available non contact mapping system have been described previously[19,20,21]. All patients were studied according to conventional electrophysiologic testing protocol and procedure. Patients were brought to the electrophysiology laboratory in fasting state. The induciblity of VT was assessed by programmed ventricular stimulation.

Under local anesthesia arterial lines were inserted through the femoral artery. First and fourth patient (Table 1) who were in sinus rhythm in the EP lab the monomorphic VT(Fig 1) was easily induced repeatedly with right ventricular pacing through the device 400/250/210 milli second and 600/270/200 milli second respectively with hemodynamic instability and was being terminated with over drive pacing. Second patient (Table 1) developed monomorphic VT in the lab at the rate of 150 beats / minute and was easily induced with post ectopic stimulation at 400/300 milli second. Third patient (Table 1) was in sinus rhythm with

Table 2: Procedures

Pt#	Procedure Time (Hrs*)	Flouroscopy Time (Hrs)	Areas of Scar	Total RFA***
1	2Hrs 15Mnts	38 Mnts**	Large area of posterior	26
2	2Hrs 45Mnts	52Mnts	Large area of anteroapical	42
3	2Hrs 20Mnts	42Mnts	Large area of posterior	32
4	3Hrs 20Mnts	48 Minutes	Large area of Anteroapical	33
5	5Hrs 3Hrs (MPT?)	2Hrs 76 Mnts (MFT??)	Large area of Anteroapical	115 49.6 pt Mnts (MFT??)

Hrs* – Hours , Mnts** – Minutes , RFA*** – Radio Frequency Ablation, pt# – patient number.
MPT? – Mean Pocedure Time.MFT?? – Mean Flouroscopy Time.
MNRFA???? – Mean Number of Radiofrequency Ablation.

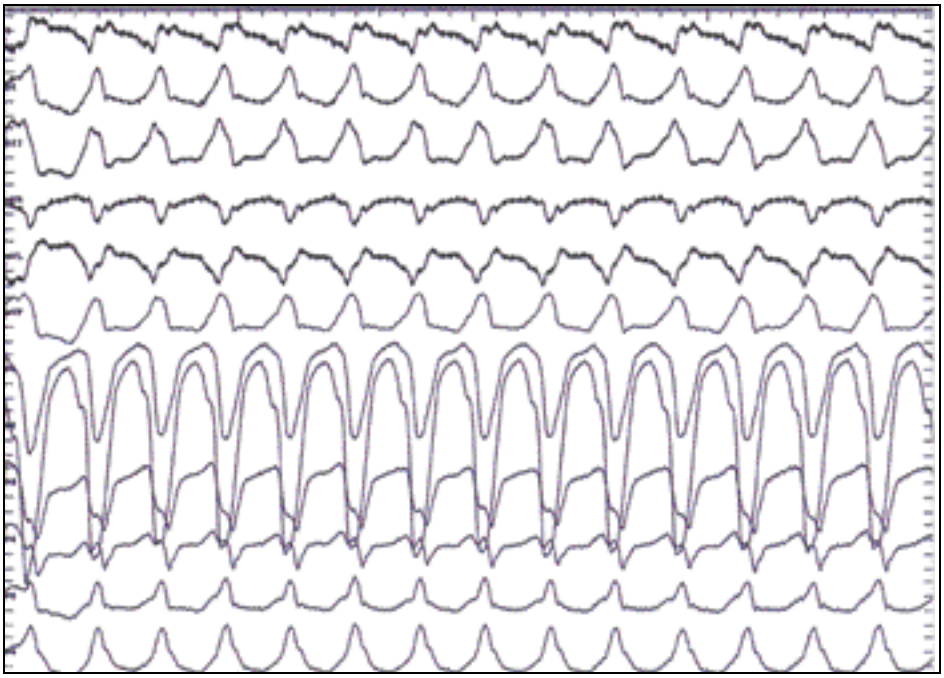


Fig. 1: *Electrocardiogram tracing showing sustained monomorphic ventricular – tachycardia of left bundle branch block morphology.*

frequent premature ventricular ectopics of right bundle branch block morphology similar to VT and developed sustained monomorphic VT with hemodynamic instability required defibrillation and others were slow VT (150 beats per minute) terminated with overdrive pacing. The fifth patient (Table 1) was also in sinus rhythm in the EP lab, developed VT with catheter manipulation and terminated with overdrive pacing.

LV angiography showed severe LV systolic dysfunction in 4 patients and mild in one patient (Table 1). EnSite Array was positioned into left ventricle in all patients. Three dimensional mapping of LV was done with balloon and scar map identified large area of antero apical scar in 3 patients (Fig. 2a1,a2,a3) and large area of posterior scar in two patients (Fig. 2b1,b2). Ventricular tachycardia was mapped with non-contact mapping system which identified the VT circuit and exit points from the scar in all patients (Fig 3). Multiple RF ablations were delivered in a line along the border of the scar and extended to the mitral annulus targeting the VT exit site from the scar (Fig. 2c1, c2). A total of 248 radio frequency applications were delivered to ablate the ventricular tachycardia (Table 2) and the mean number of radio frequency pulses was 49.6 per patient. The mean procedure time measured was 3 hours (Table 2). The mean fluoroscopy time measured was 76 minutes. All patients underwent the procedure once with complete successful ablation and rendered non inducible VT at end of procedure. No cardiac complication was observed in any of our patient during electrophysiological evaluation and radio frequency ablation procedures.

Follow Up

All patients were being regularly followed up with the report of clinical symptoms, interrogation of AICD and electrocardiographic documentation at the Heart center out patient clinic. Quality of life of all patients improved substantially and no

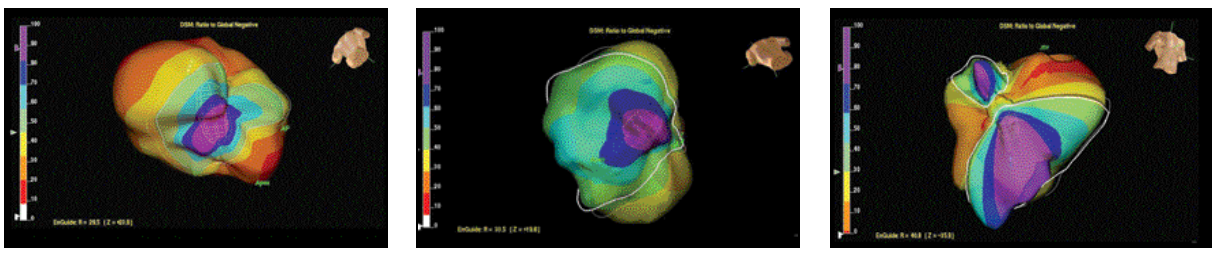
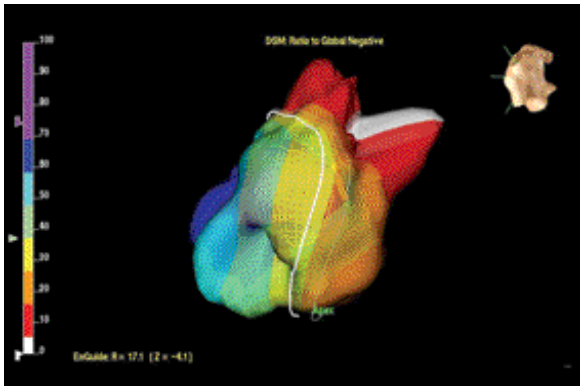


Fig. 2a1, 2a2, 2a3: *Three dimensional views showing large antero apical scars*



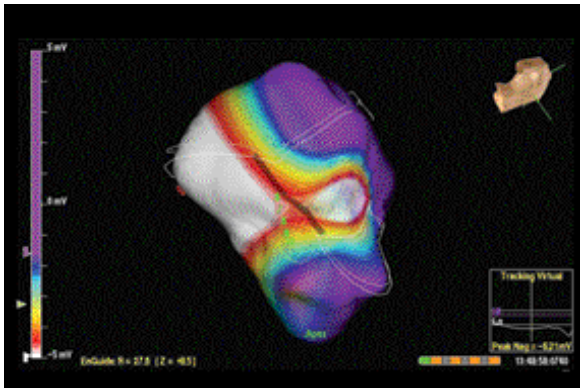


Fig. 2b1, 2b2: *Three dimensional views showing large areas of posterior scar.*

shocks from AICD were observed for a period of three to eight months. All patients continued antiarrhythmic treatment with cordarone. Only one patient had non sustained VT that did not require intervention.

Discussion

The endocardial mapping criteria, catheter mapping of VT and RF ablation of VT have been described in several studies[8,9,10]. We applied radio frequency RF ablation technique in those five patients, which showed the relevance of extended ablation along the critical borders shared by multiple exist sites to include a majority of inducible VTs and achieved a favorable outcome without any complication. The radio frequency catheter ablation of VT in patients with previous myocardial infarction is often difficult, the procedure times are relatively long and many patients required multiple procedures[11,12,13]. The presence of multiple morphologies of inducible VT has been associated with antiarrhythmic drug inefficacy[14]. Antiarrhythmic drug therapy had failed in all four patients including amiodarone. The individual based substrate description with varying degrees of voltage mapping, pace mapping and activation mapping together with the use of targeted area maps attained high efficacy of ablation technique[15].

In all five patients, catheter mapping of VT and three dimensional mapping of LV were done with balloon catheter and identified area of scar. In the present study, the endocardial non contact mapping system was used for VT substrate description as it was applied in previous studies[15,20,21]. Linear ablation along the border of scar connecting it mitral annulus eliminated the VT and rendered non induciblity. In one of our patients the VT was still inducible and exit at higher place and hence the line of ablation was extended further up along the scar area posteriorly eliminated the VT successfully.

Endocardial catheter mapping studies of VT substrate in post myocardial infarction patients have revealed re-entrant circuits in a complex three dimensional structure of normal and abnormal fibers within the border of MI or within the scar area itself[13]. Previous studies have shown that high degree of inhomogeneous

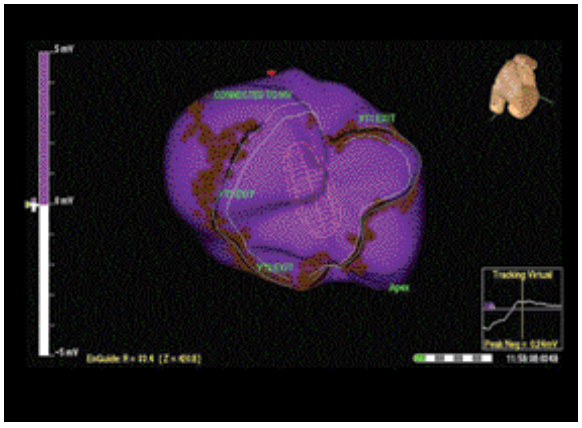


Fig. 2c1 : *Three dimensional view of multiple radio frequency ablations in a line along the border of large anterior scar connecting it to mitral annulus.*

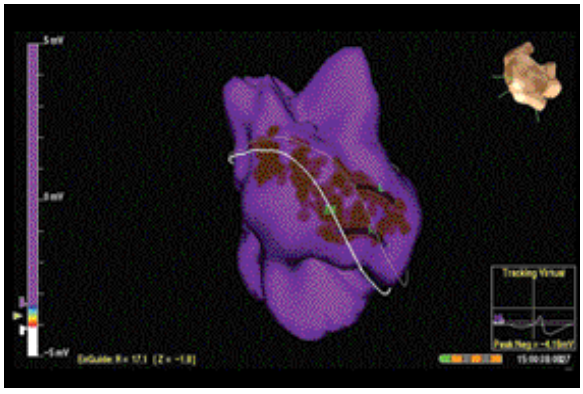


Fig. 2c2: *Three dimensional view of multiple radio frequency ablations in a line along the border of large posterior scar at the site of VT exit.*

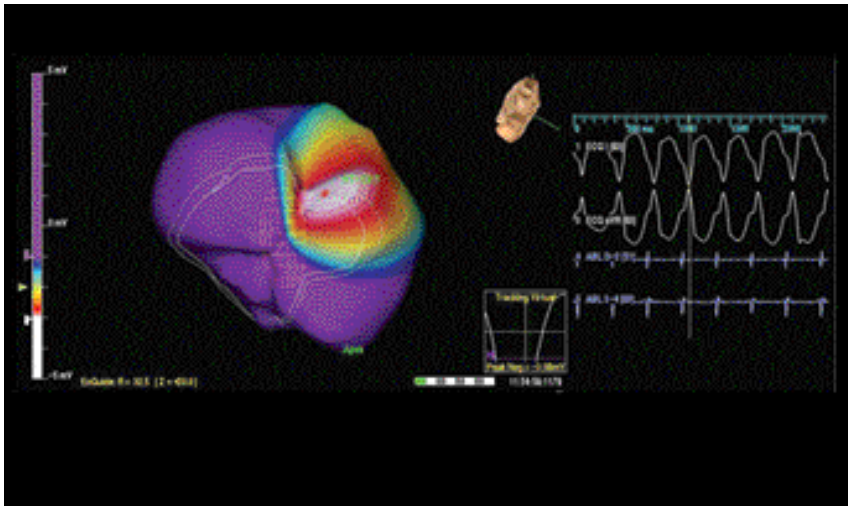


Fig.3: *Three dimensional view showing the exit of ventricular tachycardia from the scar area.*

anisotropy with a zigzag route of activation over branching and merging bundles of surviving myocyte with in the scar[18]. Bartlett et al, reported on the postmortem specimen of histological evaluation of patient with VT of prior myocardial infarction who underwent in RF catheter ablation[16]. New strategies of radio frequency ablation will not solely depend upon the mapping of individual circuits but will target the complete noninduciblity of any monomorphic VT in the arrhythmogenic substrate[15,17]. The end point of RF ablation procedure which was complete noninduciblity of any monomorphic VT was achieved in all five patients without any cardiac complications with in the limited procedure time.?

Conclusion

Our limited local experience in the electrophysiological evaluation with integration of mapping technique and radiofrequency ablation of hemodynamically unstable ischemic ventricular tachycardia in five patients with prior myocardial infarctions has been found highly successful in reducing discharges from AICD and substantial improvement in the quality of life.

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The Port of Aden and its port
from an oil painting by the Flemish painter Jan van Kessel, ea. 1664.