

Etiology, Management & Outcome of Ventricular Tachycardia in Structural Heart Disease Patients in Indian Context

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Abstract

Introduction: Ventricular tachycardia (VT) encompasses all the tachycardia's originating in the ventricular myocardium or the specialized conductive tissue distal to the atrioventricular node. Structural heart disease (SHD) plays a major role in risk stratification, initial management, risk stratification, and treatment of ventricular arrhythmias. **Aim:** The aim of the study was to study the clinical profile, various treatment modalities offered to patients and patient's acceptance for same and the outcome following various treatment modalities in patients of ventricular tachycardia in structural heart disease patients in Indian context. **Materials and methods:** 106 patients of ventricular tachycardia with underlying structural heart disease fulfilling the study criteria were enrolled in the study. All patients underwent detailed evaluation including history, clinical examination and laboratory investigations. Patients were managed according to standard guidelines. All patients were followed at 1 month, 3 months, and 6 months. **Results:** Mean age was 53.6 years, 77.36% of patients were males. Monomorphic VT was commonest presentation and found in 93.39% of patients. Most common etiology for VT was coronary artery disease in 52.84% of patients. Mean LVEF in our study was 26.46±10.82%. Patients who had LVEF of <30% had maximum mortality of 48.05%. 23 (21.69%) patients in our study had opted for AICD and underwent the procedure accordingly. The main reason behind patients not opting for AICD was the economic issue. There were 2 (8.6%) deaths in AICD group and 12 (14.81%) in non-AICD group on follow-up. **Conclusion:** In our study, the most common etiology of VT was coronary artery disease. Monomorphic VT is common in patients with underlying structural heart disease. Patients of VT with associated comorbidities and left ventricular dysfunction has higher mortality. Our study shows that the implantation of a defibrillator in patients with a prior myocardial infarction and left ventricular dysfunction, with symptomatic ventricular tachyarrhythmia have a trend towards survival benefit, compared to similar group of patients on medical follow up. But the main reason in Indian context behind not undergoing AICD implantation is economic issue.

Keywords: AICD; Ventricular Tachycardia.

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Introduction

Ventricular arrhythmias occur commonly in clinical practice and range from benign asymptomatic premature ventricular complexes (PVCs) to ventricular fibrillation (VF) resulting in sudden death. The presence of structural heart disease plays a major role in risk stratification. Initial management, risk stratification, and treatment of ventricular

arrhythmias pose a significant challenge to clinicians [1]. Empirically, a rate of 100 beats per minute is used as a lower limit for the diagnosis of ventricular tachycardia, although practically, the rate is more often in excess of 150 or even 200 beats per minute [2].

Patients who have a cardiac arrest or sustained VT frequently have underlying structural heart disease, most frequently coronary artery disease (CAD); such structural disease accounts for approximately 62% to 80% of cases of SCD [3,4].

Several studies empirically tested different pharmacological options for VT, amiodarone showed limited results with benefits due to reduction in arrhythmic death, (35% in EMIAT study and 48% in CAMIAT study) but no effects on all-cause mortality at 24 months [5].

Our study aimed to evaluate various treatment modalities offered to patients and clinical profile in case of ventricular tachycardia in structural heart disease patients in Indian context.

Materials and Methods

One Hundred Six patients of ventricular tachycardia with underlying structural heart disease fulfilling study criteria were included in the study. All patients underwent detailed evaluation including history, clinical examination, laboratory investigations and management. ECG was done at the time of admission, at the time of ventricular tachycardia and after reverting the ventricular tachycardia. All patients underwent basic and relevant biochemical investigations, 2D echocardiogram. Patients were managed and advised treatment according to guidelines. All patients were followed at 1, 3, and 6 months.

Study subjects

Patients fulfilling following criteria's were included in the study

Inclusion criteria

Patients presenting with ventricular tachycardia with underlying structural heart disease included in study.

Exclusion criteria

Patients with arrhythmia other than ventricular tachycardia with underlying structural heart disease and patients presenting with ventricular tachycardia but without underlying structural heart disease were excluded from the study.

Observations and Results

Baseline clinical Characteristics

The baseline characteristics of the study population are presented in the [Table 1]. Of 106

patients included in the study, 82 (77.36%) were male and 24 (22.64%) were female. Mean age of patients included in study was 53.6±15.2 years. In this study most common symptom was palpitation (98.11%). Majority of patients were belonging to lower middle (37.7%) socioeconomic class. Among associated comorbidities, diabetes mellitus (22.64%) was most common of all. Mean LVEF of patients in study was 26.46±10.82 %.

Table 1: Baseline clinical characteristics.

Variable	N =106
Age	
<20	03 (2.83%)
20-40	15 (14.15%)
40-60	49 (46.23%)
>60	39 (36.79%)
Gender	
Male	82 (77.36%)
Female	24 (22.64%)
Chief complaints	
Palpitation	104 (98.11%)
Syncope/pre syncope	74 (68.81%)
Angina / angina equivalent	30 (28.30%)
Dyspnea	51 (48.11%)
Perspiration	53 (50%)
Socio-economic status (according to modified kuppuswamy classification)	
Upper (U)	19 (17.924%)
Upper middle (UM)	21 (19.81%)
Lower middle (LM)	40 (37.7%)
Upper lower (UL)	20 (18.9%)
Lower (L)	6 (5.7%)
Associated comorbidities	
Diabetes mellitus	24 (22.64%)
Hypertension	22 (20.75%)
Renal failure	11 (10.3%)
Hypothyroidism	1 (0.94%)
COPD	1 (0.94%)
LVEF	
<30	77 (72.6%)
30-45	20 (18.8%)
>45	9 (8.49%)
Revascularization procedure distribution	
Done	48 (45.28%)
Not Done/ not required	58 (54.72%)

Characteristics of ventricular tachycardia

The characteristics of VT are presented in Table/ Figure 2. The most common etiology for VT in our study was coronary artery disease in 52.84% of patients. DCMP was present in 35.85% of patients. 1.89% patients had ARVD and congenital heart disease each. 0.94% patients had valvular heart disease. 3.77% patients were belonging to post-operative status. 0.94% patients had hydatid cyst, infiltrative CM, HCM each. Monomorphic VT was

commonest presentation in our study and was found in 93.39% of patients. Polymorphic VT was present in 6.60% of patients. 52.84% patients in our study were hemodynamically unstable at the time of VT event, whereas 47.16% patients were hemodynamically stable. Patients with VT presentation were cardioverted with either medical or electrical cardioversion depending on the hemodynamic status. Patients who were hemodynamically unstable 56(52.83%) were cardioverted using electrical cardioversion.

Table 2: Characteristics of ventricular tachycardia [CAD- Coronary artery disease, ARVD- Arrhythmogenic right ventricular dysplasia, HCM- hypertrophic cardiomyopathy].

Variables	Number (%)
Etiology of VT	
CAD	56 (52.84%)
DCMP	38 (35.85%)
ARVD	2 (1.89%)
Congenital heart disease	2 (1.89%)
Valvular heart disease	1 (0.94%)
Others-	
Post-surgical	4 (3.77%)
Hydatid cyst	1 (0.94%)
Infiltrative CM	1 (0.94%)
HCM	1 (0.94%)
Type of VT	
Monomorphic	99 (93.39%)
Polymorphic	07 (6.60%)
Hemodynamic stability at the time of VT	
Stable	50 (43.16%)
Unstable	56 (52.84%)
Acute management of VT	
Medical cardioversion	50 (47.17%)
Amiodarone	49 (46.23%)
Lignocaine	01 (0.9%)
Electrical cardioversion	56 (52.83%)
Long term treatment	
Medical therapy	81(76.42%)
AICD	23 (21.69%)
Others	02 (1.89%)
Drug distribution	
Beta blocker	70 (66.03%)
ACEI/ARB	52 (49.06%)
CCB	0(0)
Amiodarone	54 (50.94%)
Diuretics	64 (60.38%)
Digoxin	29 (27.36%)

Patients who revived the episode of VT were advised for long term treatment, which included medical therapy (i.e. beta blockers, amiodarone etc), AICD, catheter ablation. Patients fulfilling the eligibility criteria for AICD were advised for AICD. 23(21.69%) patients in our study had opted for AICD and underwent the procedure accordingly. The main reason behind patients not opting for AICD was the economic issue.

Outcomes of Ventricular tachycardia:

Of the 106 patients, 44 (41.51%) patients expired. Out of 44 patients, 30 patients expired in hospital after VT event. 14 patients expired on follow up over 6 months after discharge from hospital after primary event. On follow-up, 7 patients re-hospitalised for CHF, 5 for repeat episode of VT, 3 for syncope.

Comparison of AICD over medical therapy

Single chamber AICD was the commonest type of AICD inserted in 16 (69.56%) patients followed by Dual chamber in 4 (17.40%) patients. CRT-D was used in 3 (13.04%) patients.

In AICD group, one patient hospitalised due to VT, one patient due to CHF and one patient due to syncope. 15 patients didn't require rehospitalisation in AICD group. Whereas in patients taking medical therapy only, 6 patients were re-hospitalised due to CHF, 4 patients due to occurrence of VT and 2 patients for syncope.

Out of 44 patients who expired, 42 were on medical treatment and 2 were implanted with AICD.

Table 3: Comparison of AICD over medical therapy.

Variables	AICD	Medical therapy	P value
Rehospitalisation			
For CHF	1(4.35%)	6(11.76%)	0.619
For VT	1(4.35%)	4(7.84%)	0.98
For syncope	1(4.35%)	2(3.93%)	0.58
For device therapy	0(0%)	0(0%)	
Not required	20(86.95%)	39(76.47%)	0.87
Mortality			
Mortality-inhospital	00	30	
- post discharge	2	12	

Factors associated with mortality after VT

Factors associated with mortality after VT are presented in Table 4. There was one patient of valvular heart disease which had VT. Patient expired in hospital before discharge. out of 4 Postoperative patients, 2 patients expired. Mortality was 52.63% in DCMP patients.

Out of 44 patients who expired in our study, 18 (44.07%) patients had associated comorbidity.

Patients who had LVEF of <30% had maximum mortality of 48.05%. In patients with LVEF of 30-45%, mortality was 30%. Mortality was least in patients with LVEF >45%. It was statistically significant (P value= <0.0001). Mortality was 100% in polymorphic VT.

Patients who were unstable at the time of VT had maximum mortality i.e. 57.14%.

Table 4: Factors associated with mortality after VT.

Variable	Total	Mortality
Etiology		
CAD	56	21(37.5%)
DCMP	38	20(52.63%)
ARVD	2	0(0%)
Congenital heart disease	2	0(0%)
Valvular heart disease	1	1(100%)
Post-surgical	4	2(50%)
Associated comorbidities		
Comorbidity present	59	26 (44.07%)
Comorbidity absent	47	18 (38.30%)
LVEF (%)		
<30%	77	37(48.05%)
30-45%	20	6(30%)
>45%	9	1(11.11%)
Type of VT		
Monomorphic	99	37(37.37%)
Polymorphic	07	7(100%)
Hemodynamic status		
Stable	50	12(24%)
Unstable	56	32(57.14%)
Type of treatment		
Medical therapy	81	42 (51.85)
AICD	23	02 (8.69)

Discussion

In our study, of 106 patients included in the study, 82 (77.36%) were male and 24 (22.64%) were female. Similarly most trials reported male predominant study population. Higher age and male sex are known risk factor for cardiovascular related morbidity. Similarly in MADIT trial (92% male, 8% female), MADIT II (84% male, 16% female) male population was predominant.

Our study had patients with mean age of 53.6±15.2 years. MADIT trial included patients with mean age 64±9, comparable results were seen in MADIT II and MUSTT trials [6,7,8].

The most common symptom of ventricular tachycardia in our study was palpitations which was present in 98.11% patients.

Considering the cost of treatment modalities like AICD, many patients who cannot afford such treatment had refused the treatment and continued to take medical treatment only, despite need for AICD. Patients who underwent for AICD implantation belonged to upper class(82.60%) and upper middle class (17.39%).

The main reason for not undergoing AICD implantation was the economic issue in our study.

There were many etiologies causing VT in our study. The most common etiology was coronary artery

disease (52.84%). DCMP was next common etiology for VT found in 35.85% patients in our study.

In our study, mortality was more in patients with DCMP(52.63%). In a study by Hans-Joachim Trappe et al.[9], mortality in VT was higher in patients with CAD than in patients without CAD.

The incidence of diabetes mellitus was 22.64% and that of hypertension was 20.75% in our study. Whereas MADIT and MADIT II trials had higher incidence of hypertension among patients included in the trial. In a study by Meyborg mura et al. [10], 45.1% were diabetics. In MADIT and MADIT II trials the incidence of diabetes mellitus in AICD and non-AICD group was 7% and 5%, 38% and 33% respectively, whereas that of hypertension was 48% and 35%, 53% and 53% respectively.

The mean LVEF in our study was 26.46±10.82%. It was very much similar to that of in MADIT and MADIT II trials which had mean LVEF of 25±7% and 23±5% respectively. Low LVEF was found to be associated with syncope and proarrhythmia at follow-up in the Syncopal SMVT group in a study by Mauricio Abello et al.[11]. The mortality was highest(48.05%) in patients with LVEF <30%.

Monomorphic VT was commonest presentation in our study and was found in 93.39% of patients.

Hemodynamic stability is important determinant of mortality in VT. 52.84% patients in our study were hemodynamically unstable at the time of VT event, whereas 47.16% patients were hemodynamically stable. Patients who were unstable at the time of VT had maximum mortality i.e. 57.14%. Whereas those patients who were stable hemodynamically at the time of VT event had mortality of 24%. Patients after an acute event of VT were advised to undergo AICD implantation, but 21.69% patients underwent AICD implantation and 76.42% patients opted for medical therapy. The main reason behind not undergoing for AICD implantation was the economic issue.

In our study, single chamber AICD was used most commonly (69.56%).

We have studied survival as our primary endpoint to assess long term benefits of AICD insertion. There were 02 (8.6%) deaths in AICD group and 42 (40.77%) in non-AICD group. Patients assigned to receive the defibrillator had a much lower rate of death from primary arrhythmia than patients assigned to conventional therapy. It is noteworthy that there were more deaths from non-arrhythmic causes in the defibrillator group, possibly reflecting inaccuracy in classifying the cause of death. Though the results were not statistically significant but trend towards survival benefit is found. MADIT II included

Myocardial infarction with LVEF < 30% and random-ized 1232 patients without prior EPS and studied all-cause mortality as primary endpoint. They re-reported 14.2% deaths in ICD group whereas 19.8% in medically managed group. MADIT II trials had 31% reduction in the risk of death in defibrillator group compared with conventional medical therapy. In contrast, MADIT trial survival rate improved within the few months after the implantation of the device, MADIT II had showed survival benefit after nine months after device implantation. The mortality rate in the conventional-therapy group was high (32 percent at two years), but it was consistent with that previously reported for a similar group of patients with inducible or non-suppressible ventricular tachycardia. MADIT trial reported 24 months mortality being 32% whereas AVID trial which had ICD inserted for secondary prophylaxis reported 24% mortality at 24 months. The CABG-patch trial had 18% mortality in defibrillator group. In observational studies by Chan et al., Bokhari et al. and Ermis et al., the all-cause mortality was reported to be 13.9%, 26.0% and 20.9% in AICD group respectively [12,13,14].

Table 5: Comparison of mortality in various trials.

Studies	All-cause mortality(%)	
	AICD	Non-AICD
Our study	8.6	40.77
MADIT	15.7	38.6
MADIT II	14.2	19.8
MUSTT	25.0	32.0
Bokhari et al	26.0	46.61
Chan et al	13.9	19.7
Ermis et al	20.9	40.6

In our study, hospitalization was not required in 39(76.47%) and 20(86.95%) patients in AICD and non-AICD group respectively. Among hospitalized patients, 4.35% were hospitalized for VT and 4.35% for device therapy in AICD group, whereas 11.76% patients were admitted due to CHF and 7.84% due to VT in non-AICD group.

Limitations of Study

During the follow up no patients of AICD group had any AICD related problem. However our sample sizes was small and follow up period of 6 months was short to detect any AICD related problem.

Radiofrequency ablation as definite therapy for VT was not done in majority of patients.

Also electrophysiological study to look for inducible VT was not done in patients we studied, which in other studies has demonstrated a statistically significant higher mortality rate

among patients who had inducible ventricular arrhythmias on EPS.

Although some might consider our use of overall mortality, rather than mortality due to arrhythmia, as the primary end point to be a limitation of the study, in fact it is a major strength. Particularly in an unblinded study, classification of death according to cause may be subject to bias.

Conclusion

The most common etiology of VT was DCMP and most common symptom was palpitations. Monomorphic VT is common in patients with underlying structural heart disease. Patients of VT with associated comorbidities and left ventricular dysfunction has higher mortality. Our study shows that the implantation of a defibrillator in patients with a prior myocardial infarction and left ventricular dysfunction, with symptomatic ventricular tachyarrhythmia have a trend towards survival benefit, compared to similar group of patients on medical follow up. But the main reason in Indian context behind not undergoing AICD implantation is economic issue.

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Conflicting Interest: None declared

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