

Management of patients with ventricular tachycardia in Europe: results of the European Heart Rhythm Association survey

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The purpose of this European Heart Rhythm Association (EHRA) survey was to assess clinical practice in the management of ventricular tachycardia (VT). The data are based on an electronic questionnaire sent to the members of the EHRA Research Network. Responses were received from 31 centres in 16 countries. The results of the survey show that the management of VT is in general in accordance with guidelines. Antiarrhythmic drugs are still frequently used for VT treatment. In patients at high risk of sudden cardiac death, an implantable cardioverter-defibrillator is routinely recommended, while the treatment options vary for patients with moderate or low risk. A discreet attitude is adopted for catheter ablation in high-risk patients as demonstrated by a relatively low rate of catheter ablation.

Keywords

Ventricular tachycardia • Antiarrhythmic drugs • Catheter ablation • Implantable cardioverter-defibrillator • EHRA survey • EP Wire

Introduction

Ventricular tachycardia (VT) is an important cause of morbidity and sudden cardiac death. Several guideline recommendations on the management of VT have been published.^{1,2} In clinical practice, however, adherence to guidelines may vary, especially in patients with structural heart disease. We, therefore, aimed to investigate the current situation of VT management in Europe.

Methods and results

Participating centres

The survey was based on the electronic questionnaire sent out to the European Heart Rhythm Association (EHRA) Research Network centres. Responses were received from 31 centres in 16 countries and of these, 83.9% were university hospitals, 9.7% private hospitals, and 6.4% other type of hospital. Five centres (16.1%) each treated ≥ 400 VT patients per year, 5 (16.1%) treated

200–400 per year, 10 (32.3%) 100–200 per year, 8 (25.8%) 50–100 per year, and 3 (9.7%) centres treated < 50 patients per year. Treatment with antiarrhythmic drugs (AADs), implantable cardioverter-defibrillators (ICDs), and catheter ablation was available in all participating centres except for three in which VT ablation was not performed.

Investigation of underlying heart disease

Most (58%) sustained VTs were secondary to coronary artery disease, 22% were due to non-ischaemic cardiomyopathy, 12% were idiopathic without detectable heart disease, 5% were related to channelopathies, and 3% were associated with other reasons.

After VT was clinically documented, different examinations were performed in ischaemic and non-ischaemic heart disease (Figure 1). Seventeen (54.8%) centres performed invasive electrophysiological (EP) study in patients with documented sustained VT for several purposes, including selecting the treatment strategy (54.8%),

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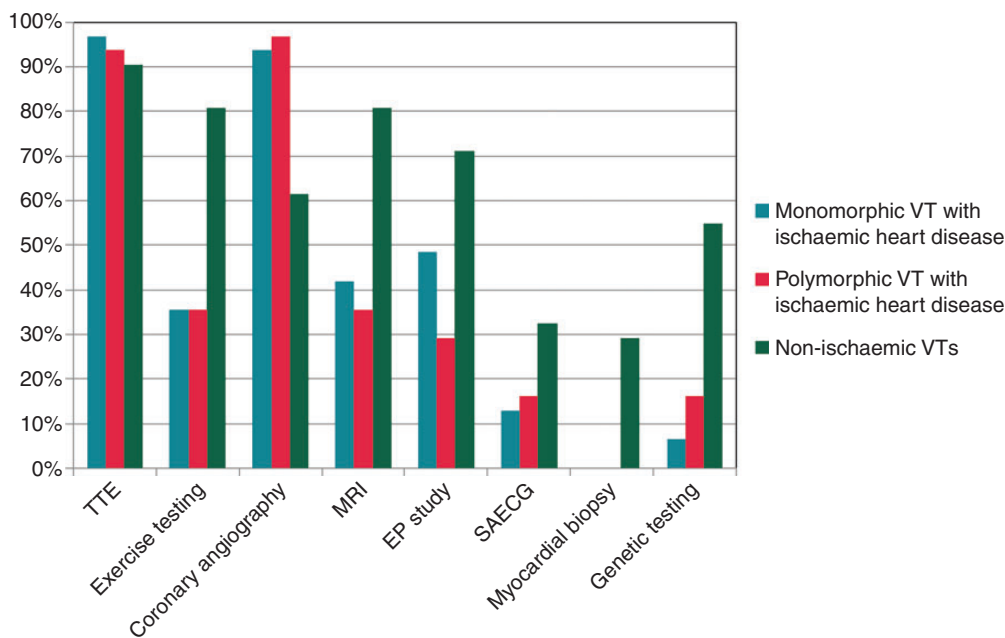


Figure 1 Investigations performed in patients with ischaemic and non-ischaemic heart diseases after VT was clinically documented. EP, electrophysiological; MRI, magnetic resonance imaging; SAECG, signal-averaged electrocardiogram; TTE, transthoracic echocardiography; VT, ventricular tachycardia.

evaluating ventricular electrical instability (22.6%), testing the efficacy of AADs (9.7%), and optimizing ICD programming (9.7%).

Antiarrhythmic drugs

To prevent recurrent haemodynamically stable VTs, AADs were prescribed in most centres and in addition, an ICD would be implanted if there was an indication. For idiopathic VT, first choice AADs were β -blockers, Ca^{2+} channel blockers, and flecainide in 77.4, 9.7, and 9.7% of the participating centres, respectively. For VT with ischaemic heart disease, β -blockers and amiodarone were first choice in 58.1 and 41.9%, respectively. For VT with dilated cardiomyopathy, AADs included β -blockers, amiodarone, and sotalol in 40, 56.7, and 3.3% of the centres, respectively. In hypertrophic cardiomyopathy, β -blockers, amiodarone, and disopyramide were used in 67.7, 25.8, and 3.2%, respectively, while one centre chose not to use any AAD for this condition.

For VT due to arrhythmogenic right ventricular cardiomyopathy, first choice AADs included β -blockers, sotalol, amiodarone, and flecainide in 58.1, 22.6, 16.1, and 3.2%, respectively. For VT related to Brugada syndrome, a β -blocker was the first choice in 35.5% of the centres, while 25.8% chose other AADs which were not listed in the questionnaire and no AAD was prescribed in 29%. For catecholaminergic polymorphic VT, a β -blocker was the first choice in 93.6%.

To evaluate the effect of AADs, Holter monitoring was employed in 60.0%, only clinical follow-up in 56.7%, exercise testing in 33.3%, implantable loop recording in 10%, while programmed electrical stimulation was used only in 6.7%. If the patient had an ICD, 90% of the centres used device interrogation.

Catheter ablation

Before VT ablation, AADs were withdrawn in 13.3% irrespective of the type of VT or class of AADs. Except for amiodarone, AADs were withdrawn in 13.3%, never withdrawn in 6.7%, while 66.7% of centres managed AADs individually depending on the VT type and the presence of structural heart disease. If post-myocardial infarction VT episodes occurred after ICD implantation, patients were referred for catheter ablation in the following situations: frequent shocks due to VT in 36.7%, recurrent VT irrespective of haemodynamic response in 26.7%, after failure of amiodarone in 16.7%, after the first shock due to VT in 13.3%, and recurrent haemodynamically unstable VT in 6.7%. Of 27 centres performing VT ablation 2 used a single method for mapping scar-related VT, while 25 employed combined techniques, including substrate mapping during sinus rhythm (83.3%), targeting mid-diastolic potentials during VT (76.7%), entrainment analysis (66.7)%, pace mapping of QRS morphologies (66.7)%, and mapping of earliest ventricular activation during VT (43.3%).

Epicardial VT ablation was performed after failure of endocardial approach in 13 centres, and as a combined epicardial and endocardial approach at the first procedure in five centres, whereas nine centres never performed epicardial VT ablation. Endpoints for ablation procedures and investigations during follow-up for different VTs are listed in *Table 1*.

Implantable cardioverter-defibrillators

In patients with post-myocardial infarction VT, all centres reported implanting ICDs in patients with left ventricular ejection fraction (LVEF) $\leq 35\%$. If LVEF was 35–40%, 69% of the centres would

Table 1 Evaluations for acute and long-term success after catheter ablation of VT

	Endpoints of ablation procedure			Investigations used for evaluating the efficacy of catheter ablation during the long-term follow-up						
	Termination of clinical VT during ablation	Non-inducibility of VT after ablation	Modification of substrate	Others	12-Lead ECG	Holter monitoring	Exercise testing	Programmed electrical stimulation	Implantable loop recording	ICD interrogation if patient has
Post-myocardial infarct VT	29.2	79.2	58.3	8.3	50.0	63.3	36.7	6.7	6.7	93.3
VT with non-ischaemic cardiomyopathy	25.0	83.3	50.0	8.3	50.0	66.7	30.0	6.7	10.0	93.3
Idiopathic VT	33.3	70.8	0	12.5	56.7	86.7	60.0	3.3	3.3	60.0

Figures represent percentage of participating centres. ECG, electrocardiogram; ICD, implantable cardioverter-defibrillator; VT, ventricular tachycardia.

implant an ICD with no further testing, while 31% would base the decision on the results of an EP study; and if LVEF was normal, an ICD would be implanted in 24.1%, definitely not implanted in 34.5%, and 41.4% of the centres would make the decision based on the results of EP study. Similarly, all centres reported implanting ICDs in patients with VT, non-ischaemic cardiomyopathy, and LVEF \leq 35%. If LVEF was 35–40%, 65.5% of the centres would implant an ICD, while 20.7% would base the decision on the results of EP study; if LVEF was normal, ICD would be implanted in 27.6% and not implanted in 37.9%, while in 34.5% the decision would depend on the results of EP study.

When electrical storm occurred after ICD implantation in the absence of a reversible cause, 76.7% of the centres would first optimize medical therapy followed by catheter ablation, 20.0% would optimize medical therapy and ICD programming for VT detection and shock, and 3.3% would consider general anaesthesia. When patients with an ICD had recurrent VTs with frequent shocks during the long-term follow-up, 60.0% of the centres would optimize medications and refer patients for catheter ablation, 26.7% would consider ablation as the first line, and 13.3% would optimize medications and ICD programming for VT detection and shock.

Treatment choices in patients with recurrent non-sustained monomorphic VT, sustained monomorphic VT, and polymorphic VT in different heart diseases are presented in Tables 2–4.

Discussion

The management of VT in various clinical settings is challenging. This EP Wire survey provides an insight into VT management in Europe. Coronary artery disease has been recognized to be the major cause of VT. Consequently, examinations including transthoracic echocardiography, exercise testing, coronary angiography, and magnetic resonance imaging were widely used in most centres in order to diagnose and differentiate ischaemic from non-ischaemic heart disease,³ whereas signal-averaged electrocardiography, myocardial biopsy, and genetic testing were seldom employed. Magnetic resonance imaging was frequently used in patients with less defined substrate, which is in line with the guidelines.^{2,4} Meanwhile, EP study was employed in only half the centres, which was less frequent compared with the results of an earlier survey,⁵ indicating that the role of EP study was diminishing as a tool of risk evaluation for sudden cardiac death. To some extent, the aims of EP studies also changed.⁴

This survey has demonstrated that left ventricular systolic function, haemodynamics, underlying heart disease, and duration of VT are the major determinants of VT treatment in Europe. For patients with LVEF \leq 35%, ICD implantation has become the first choice, confirming the adherence to current recommendations.^{6,7} In these patients, catheter ablation serves only as an adjunct to ICD or AAD treatment, or is not considered. The situation is similar for catheter ablation in patients with haemodynamically unstable recurrent polymorphic VT, most likely because ablation has been reported to be associated with high risk of complications, difficulties identifying suitable targets, and poor prognosis in these patients.^{8,9} When underlying heart disease, normal LVEF, and stable haemodynamics are identified in patients with monomorphic VT, the duration of VT plays an important role in selecting therapy.

Table 2 Treatment choice in haemodynamically stable patients with recurrent sustained monomorphic VT

	AAD				ICD				Ablation			
	First choice	Second choice	Third choice	Not considered	First choice	Second choice	Third choice	Not considered	First choice	Second choice	Third choice	Not considered
Post-myocardial infarct												
LVEF ≤35%	6.7	66.7	23.3	3.3	93.3	3.3	0	3.3	6.7	30.0	63.3	0
LVEF normal	46.7	36.7	16.7	0	17.3	31.0	37.9	13.8	40.0	33.3	26.7	0
Non-ischaemic cardiomyopathy												
LVEF ≤35%	10.3	69.0	17.2	3.5	90.0	6.7	0	3.3	3.5	20.7	72.4	3.4
LVEF normal	50.0	43.3	6.7	0	24.1	20.7	41.4	13.8	27.6	31.0	34.5	6.9
Idiopathic	46.7	46.7	3.3	3.3	6.9	3.4	48.3	41.4	43.3	46.7	3.3	6.7

Figures represent the percentage of participating centres. The most frequent first choice for each disease state is in bold. AAD, antiarrhythmic drug; ICD, implantable cardioverter-defibrillator; LVEF, left ventricular ejection fraction.

Table 3 Frequency of treatment choice in haemodynamically stable patients with recurrent non-sustained monomorphic VT

	AAD				ICD				Ablation			
	First choice	Second choice	Third choice	Not considered	First choice	Second choice	Third choice	Not considered	First choice	Second choice	Third choice	Not considered
Post-myocardial infarct												
LVEF ≤35%	20.0	66.7	3.3	10.0	70.0	6.7	16.7	6.7	6.7	20.0	46.7	26.7
LVEF normal	70.0	20.0	0	10.0	3.3	23.3	30.0	43.3	16.7	30.0	26.7	26.7
Non-ischaemic cardiomyopathy												
LVEF ≤35%	23.3	70.0	3.3	3.3	70.0	6.7	16.7	6.7	3.3	16.7	30.0	26.7
LVEF normal	80.0	13.3	0	6.7	3.6	21.4	21.4	53.6	13.8	41.4	20.7	24.1
Idiopathic	60.0	30.0	0	10.0	0	0	34.5	65.5	40.0	50.0	0	10.0

Figures represent the percentage of participating centres. The most frequent first choice for each disease state is in bold. AAD, antiarrhythmic drug; ICD, implantable cardioverter-defibrillator; LVEF, left ventricular ejection fraction.

Table 4 Frequency of treatment choice in haemodynamically unstable patients with recurrent sustained polymorphic VT

	AAD			ICD			Ablation					
	First choice	Second choice	Third choice	Not considered	First choice	Second choice	Third choice	Not considered	First choice	Second choice	Third choice	Not considered
Post-myocardial infarct												
LVEF \leq 35%	13.8	75.9	3.4	6.9	80.0	13.3	0	6.7	6.9	10.4	44.8	37.9
LVEF normal	40.0	50.0	3.3	6.7	53.3	23.3	3.4	20.0	3.3	10.0	46.7	40.0
Non- <i>ischaemic</i> cardiomyopathy												
LVEF \leq 35%	13.8	79.3	0	6.9	80.0	10.0	3.3	6.7	6.9	3.5	51.7	37.9
LVEF normal	44.8	41.4	6.9	6.9	50.0	16.7	3.3	30.0	6.9	13.8	37.9	41.4

Figures represent the percentage of participating centres. The most frequent first choice for each disease state is in bold. AAD, antiarrhythmic drug; ICD, implantable cardioverter-defibrillator; LVEF, left ventricular ejection fraction.

Treatment with AADs is the major choice for non-sustained VT in most centres, while AAD treatment or catheter ablation is considered for sustained VT. The treatment decision in these patients is probably made according to the prognosis of their heart disease, symptoms, and patient preference. In patients without structural heart disease, AAD treatment is still the first choice in half the centres, even though ablation has been recommended as first-line therapy for sustained monomorphic VT.²

Antiarrhythmic drugs still play a key role in VT therapy. In accordance with the recommendations,^{1,2} β -blockers are the most frequently prescribed medications for VT in the majority of the centres. Notably, some centres chose β -blockers for VT related to Brugada syndrome though it is not recommended by the guidelines.^{2,10} Amiodarone has also been prescribed frequently for treating VT in half the centres probably due to low risk for the pro-arrhythmic effects in patients with structural heart disease. With the exception of idiopathic VT, the majority of the centres employed catheter ablation as an adjunct strategy for VT patients after optimizing treatment with AAD and ICD programming. Whether AADs were withdrawn or not prior to ablation depended on the type of VT and the presence of heart disease. This indicated that most of the centres were cautious to interrupt AADs in high-risk patients.

During ablation of scar-related VT, most centres selected combined mapping techniques and used non-inducibility of VT as the procedure endpoint. It may relate to the findings that patients in whom the endpoint of non-inducibility has been achieved have a lower rate of recurrent VT and cardiac death than those who remained inducible.^{9,11} However, this additional benefit has not been shown in patients with LVEF \leq 30%.⁹ Thus, LVEF may be an important index for the selection of an ablation endpoint.

Epicardial ablation has been implemented in half the centres in a context of failure of endocardial ablation procedures, although several centres combined it with an endocardial approach at the first procedure. This indicates that epicardial ablation is gaining the more widespread acceptance in Europe, but the technique is not yet developed in all centres.

In patients with LVEF \leq 35%, an ICD would be implanted in all centres irrespective of the type of VT or haemodynamics, which is consistent with the current guideline recommendation. At least one-third of the centres, however, would consider EP testing as an important tool to assess the indication for ICD implantation in patients with LVEF $>$ 35%, even if EP testing is not a class I recommendation. This may indicate stricter requirements for ICD implantation in some centres. In patients with a VT storm without a reversible cause or patients with recurrent VT with frequent ICD shocks, optimizing medications rather than catheter ablation is the first choice in the majority of the centres, which may reflect a cautious attitude to ablation in these circumstances.

In order to evaluate the efficacy of AADs and catheter ablation during the long-term follow-up, continuous monitoring was the preferred method. The majority of the centres would do this by ICD interrogation. Of note, few centres would implant an internal loop recorder for this purpose. Similarly, programmed electrical stimulation was seldom used probably because of its invasive nature and potential procedure-related risks.

Conclusions

This EP Wire has shown that the clinical practice in Europe regarding management of VT generally is in accordance with the guidelines. In patients with high risk for sudden cardiac death, an ICD is routinely implanted, while the treatments vary among the patients with moderate and low risk. Antiarrhythmic drugs are still frequently used for VT treatment. A cautious attitude is adopted for catheter ablation in high-risk patients.

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