

How are European patients at risk of malignant arrhythmias or sudden cardiac death identified and informed about their risk profile: results of the European Heart Rhythm Association survey

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The purpose of this EP wire is to examine clinical practice in the field of screening of patients of risk of ventricular arrhythmias and/or sudden cardiac death (SCD) in European countries. A systematic screening programme existed in the majority of centres and was organized by a multi-disciplinary dedicated team or by an activity programme of implantable cardioverter-defibrillator (ICD) or heart failure clinics. In particular, high-risk subgroups of patients with ischaemic and non-ischaemic cardiomyopathy ICD implantation are considered strongly indicated within 90 days of myocardial revascularization or initial diagnosis. Cardiac magnetic resonance imaging appears as an important tool to better characterize the left ventricular arrhythmogenic substrate in patients at risk of SCD.

Keywords

Sudden cardiac death • Risk stratification • Malignant tachyarrhythmias • EHRA survey • EP Wire

Introduction

The rate of sudden cardiac deaths (SCDs) per year in Europe has ranged from 200 000 to 350 000, with estimates that 50–70% are due to tachy-arrhythmic mechanisms. Strategies to reduce SCD must focus on better screening and identification of risk factors and diverse pathogenesis for SCD. An ideal risk stratification strategy would identify those patients who will experience SCD due to a reversible ventricular tachy-arrhythmia within some specified time period.^{1–8} The survey will include several questions about the strategy and the clinical tools for identification of best candidates for therapy such as implantable cardioverter-defibrillator (ICD).⁹

Methods and results

Responses were received from 28 partners of the EHRA Research Network. There was a wide geographic distribution of respondents, with responses received from 18 countries (3 centres in Denmark, Germany, Italy, and Spain; 2 centres in Belgium and Greece; and 1 centre in Armenia, Austria, Estonia, France, Georgia, Israel, Lithuania, Luxembourg, Netherlands, Scotland, Serbia, and UK).

Screening programme for patients at risk of sudden cardiac death

A dedicated programme for the selection of patients at high risk of malignant ventricular arrhythmias and SCD was in use in the majority of centres (22, 79%); the programme was organized by a multi-disciplinary dedicated team in 12 centres (43%), by an activity programme of ICD clinic in 5 centres (18%), of heart failure clinic in 3 centres (11%), and of coronary care unit in 2 centres (7%). Patients with post-myocardial infarction or ischaemic heart disease were informed about risk factors of SCD by the clinical cardiologist in 18 centres (64%), by the electrophysiology team in 7 centres (25%), and by the heart failure clinic team in 3 centres (11%). The family doctors were not involved in this assessment in any centre. In patients with ischaemic cardiomyopathy, all the collaborating centres reported a multiple time programme to assess the risk of SCD. Assessment occurred after 3 months of optimal medical therapy and after reassessment of left ventricular ejection fraction (LVEF) in 17 centres (61%) at 6 weeks after acute myocardial infarction and/or 3 months after revascularization (MADIT II criteria) in 10 centres (35%). Other strategy included a single scheduled follow-up

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time in five centres (18%), and before discharge after admission for acute myocardial infarction in three centres (11%).

Looking in detail at the information strategies adopted for risk assessment of SCD, 13 centres considered that the use of the national guidelines on risk stratification and ICD implantation was very important, 11 centres referred their patients to a dedicated team for risk stratification, and 4 centres applied also a local medical strategy based on hospital policy and economic budget. The involvement of the family after the initial contact with the patient was mandatory by six centres.

Non-invasive and invasive tests for risk stratification of sudden cardiac death

In patients with coronary artery disease, the main electrocardiographic parameters that were considered fundamental for SCD risk stratification, in addition to LVEF, were QRS duration in 12 centres (43%), signal averaged ECG data in 3 centres (11%), QT interval and QT dispersion in 1 (3%) centre. Of note, the remaining 12 centres (43%) did not include these parameters in their stratification policy. Looking at the long-term ECG recordings, ventricular ectopy and non-sustained ventricular tachycardia (VT) were considered important for risk stratification in 23 centres (82%), while long-term heart rate variability and heart rate turbulence were not reported as essential for this purpose.

In terms of exercise capacity and functional status evaluation, the vast majority of collaborating centres (26, 93%) considered it fundamental to perform exercise testing and to assess NYHA function class in order to obtain an optimal SCD risk stratification of patients suffering from ischaemic heart disease. On the contrary, only a minority of centres (3, 7%) stratified this large cohort of patients on the basis of T-wave alternans and heart rate recovery testing. For this purpose, no centre reported the use of baroreceptor sensitivity test.

In order to assess myocardial vulnerability and the risk of SCD in patients with coronary heart disease, electrophysiological study (EPS) with programmed stimulation was considered essential in 20 centres (72%), while it was not performed in the remaining 6 (28%). In particular, EPS was indicated for patients with syncope independently of LVEF value in 13 centres (46%), in cases with LVEF between 35 and 40% and non-sustained VT 6 weeks after acute myocardial infarction (MUSTT criteria) in 6 centres (21%) and in patients with abnormal non-invasive tests in 3 other (11%) centres.

In patients with previous myocardial infarction cardiac magnetic resonance imaging (MRI) was used for characterization of infarct size and myocardial viability by 19 centres (68%). Cardiac MRI was exclusively used for better risk definition for patients with LVEF < 40% in 10 centres (36%), for patients with non-effective myocardial revascularization in 3 centres (11%), for ICD implantation candidates on the basis of MADIT II or SCD-HeFT inclusion criteria in 4 centres (14%), and for candidates to CRT-D implantation in the remaining 2 centres (7%).

For primary prevention of SCD in patients with hypertrophic cardiomyopathy (HCM), family history of premature HCM-related SCD and unexplained syncope was the major clinical risk factors in the majority of participating centres, followed by extreme left ventricular hypertrophy, the presence of non-sustained VT and,

finally, hypotensive blood pressure response during exercise. Nine centres (37%) considered the presence of multiple abnormal tests as a priority for ICD indication.

Indications for implantable cardioverter-defibrillator therapy in particularly high-risk groups of patients

The indications for these high-risk groups are illustrated in Figure 1A–C.

An ICD implantation was planned within 90 days of revascularization by percutaneous coronary intervention (PCI) or coronary artery bypass graft (CABG) in 11 centres (39%) only for patients with VT or ventricular fibrillation episodes >48 h after an acute myocardial infarction and in whom myocardial revascularization is unlikely to result in improved LVEF (>35%), in 9 centres (32%) exclusively only for patients who have previously qualified for the ICD implantation for secondary prevention of SCD and have an abnormal LVEF, and in the remaining 8 centres (29%) for both clinical conditions.

In patients within 40 days of myocardial infarction or 90 days of revascularization for whom a recovery of low LVEF is uncertain and permanent pacing is required, 17 centres (61%) considered ICD therapy in those with sustained ventricular arrhythmias >48 h after myocardial infarction, as well as for patients with syncope that is thought to be due to ventricular arrhythmias and for patients who meet primary prevention criteria for ICD implantation. The remaining 11 centres (39%) indicated ICD implantation in the presence of only one of these three clinical settings.

For patients with non-ischaemic cardiomyopathy, an ICD implantation was recommended after the first 3 months from the initial diagnosis in 13 centres (48%), after the first 9 months from the initial diagnosis in 2 centres (7%), <3 months from the initial diagnosis in patients who met primary prevention criteria for ICD therapy and recovery of LVEF was uncertain in 7 centres (23%), while it was only recommended in patients with LVEF <35% combined with left bundle branch block in the remaining 6 centres (22%). Moreover, in the group of patients with non-ischaemic cardiomyopathy and a permanent pacing indication, an ICD implantation with appropriate pacing mode was considered <3–9 months from the initial diagnosis in 12 centres (41%) for patients in whom recovery of LVEF was uncertain or not expected, in 9 centres (33%) for patients with CRT indication, in 7 centres (26%) for patients with syncope of unknown origin.

Discussion

The main findings of this survey of 28 European centres are summarized and discussed as follows.

Screening programme for patients at risk of sudden cardiac death

The majority of participating centres has a multidisciplinary dedicated programme for screening evaluation of patients at risk for SCD including such risk evaluation in device and heart failure clinics. This multidisciplinary approach reflects the importance of combining multiple variables from the patient's history, clinical

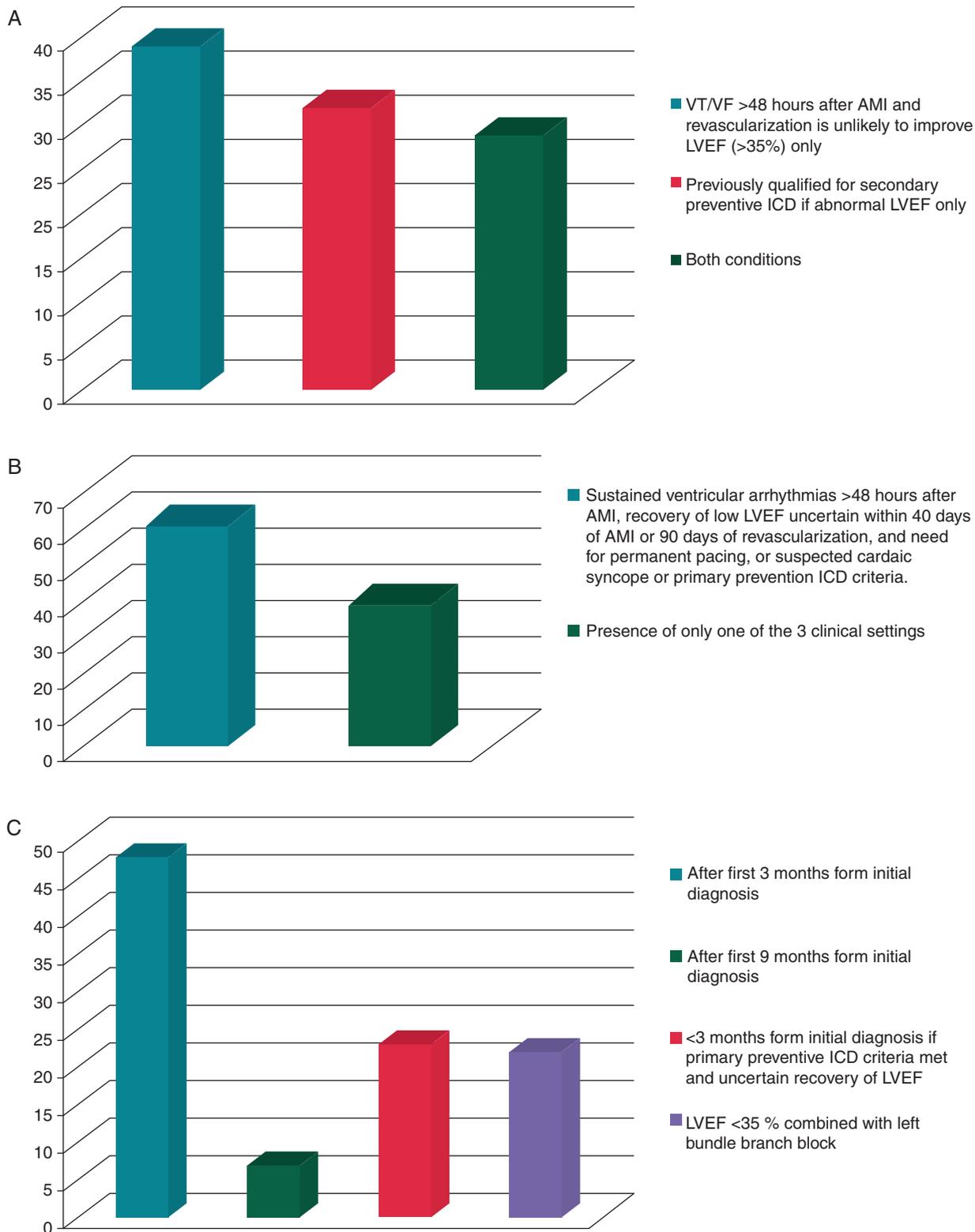


Figure 1 (A) Implantable cardioverter-defibrillator therapy within 90 days of revascularization in high-risk groups of patients, %. (B) Implantable cardioverter-defibrillator therapy in particularly high-risk groups of patients with uncertain recovery of low LVEF within 40 days of AMI or 90 days of revascularization, %. (C) Implantable cardioverter-defibrillator indications for patients with non-ischaemic cardiomyopathy, %.

characteristics, and invasive and non-invasive risk stratification tools.^{1,2,6,10} Most of the patients with ischaemic heart disease were informed about their risk profile by the clinical cardiologist, followed by the electrophysiology and heart failure team. In accordance to existing guidelines,^{9,11} the risk of SCD was established in the majority of centres after 3 months of optimal medical therapy and after reassessment of LVEF, and at 6 weeks after myocardial infarction and/or 3 months after revascularization. The rationale for waiting 90 days after CABG or PCI is based upon the premise that left ventricular function can improve sufficiently to raise the LVEF to >35%, although it remains a major challenge to predict those patients who will or will not significantly improve their LVEF.^{11–16}

For the risk assessment of SCD, only 44.8% of the centres applied directly the National and International Guidelines on SCD prevention and ICD implantation, while 39.3% of centres referred the patients to a dedicated team. The remaining 14.3% of the centres adopted a local medical strategy. The family doctors were never involved for the definition of SCD risk profile.

Non-invasive and invasive tests for sudden cardiac death risk stratification

The EP survey indicates that in patients with coronary artery disease and low LVEF the vast majority of centres considered the presence of ventricular ectopy, non-sustained VT, and functional status assessment to be fundamental for SCD risk stratification. Other non-invasive testings, such as signal average ECG data, QT interval dispersion, T-wave alternance, long-term heart rate variability, and heart rate turbulence, were not considered as essential for this purpose. These results reflect the contradictory results of previous studies evaluating the prognostic value of non-invasive tests that cannot be recommended as independent risk-stratifying tools.^{1,6}

According to the previous studies in the majority of centres, an EPS with programmed electrical stimulation plays an important prognostic role in patients at risk of sustained VT and/or ventricular fibrillation after myocardial infarction and after revascularization due to syncope episodes and/or the presence of non-sustained VT. In clinical practice, an invasive study may be useful for patient with an LVEF between 35 and 40% and a high-risk clinical profile, because a positive test indicates a high risk for SCD.^{17–19}

Cardiac MRI was indicated for several clinical conditions such as infarct size and assessment of myocardial viability, assessment of myocardial revascularization and better selection of candidates to ICD therapy according to inclusion criteria of main trials.⁶

Indications for implantable cardioverter-defibrillator therapy in selected high-risk patients

In patients with a recent myocardial infarction and a history syncope, the majority of centres considered this a potentially serious issue, and ICD implantation was recommended regardless of infarction timing if syncope was thought to be due to a ventricular arrhythmia by clinical history, or the patients had non-sustained VT or inducible VT at EPS.^{9,11}

In the setting of primary prevention, revascularization within 90 days after MI without significant LVEF improvement was considered as an indication for ICD implantation in the majority of responding

centres.^{20,21} Even in patients within 90 days of revascularization who were previously qualified for ICD implantation in the setting of secondary prevention and have abnormal LVEF ICD implantation was highly recommended.

In patients with non-ischaemic cardiomyopathy, ICD implantation for SCD primary prevention was considered very useful between 3 and 9 months after initial diagnosis if recovery of LVEF was unlikely and if they required non-elective permanent pacing.^{11,20} In the last subgroup of patients, a selection of an ICD with appropriate pacing mode was essential.

Conclusion

The ‘Screening and risk evaluation of patients at risk of malignant arrhythmias or sudden cardiac death survey’ demonstrates that most participating European centres have a screening evaluation programme of SCD, and the selection of ICD candidates was mainly based on clinical risk stratification. Cardiac MRI appears as an important tool to better characterize the left ventricular arrhythmogenic substrate in patients with coronary artery disease. In particular, high-risk subgroups of patients with ischaemic and non-ischaemic cardiomyopathy ICD implantation are considered strongly indicated within 90 days of myocardial revascularization or initial diagnosis.

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