



## Complete Summary

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### GUIDELINE TITLE

ACC/AHA/ESC 2006 guidelines for management of patients with ventricular arrhythmias and the prevention of sudden cardiac death. A report of the American College of Cardiology/American Heart Association Task Force and the European Society of Cardiology Committee for Practice Guidelines (Writing Committee to Develop Guidelines for Management of Patients With Ventricular Arrhythmias and the Prevention of Sudden Cardiac Death).

### BIBLIOGRAPHIC SOURCE(S)

European Heart Rhythm Association, Heart Rhythm Society, Zipes DP, Camm AJ, Borggrefe M, Buxton AE, Chaitman B, Fromer M, Gregoratos G, Klein G, Moss AJ, Myerburg RJ, Priori SG, Quinones MA, Roden DM, Silka MJ, Tracy C, Smith SC Jr, Jacobs AK, Adams CD, Antman EM, Anderson JL, Hunt SA, Halperin JL, Nishimura R, Ornato JP, Page RL, Riegel B, Priori SG, Blanc JJ, Budaj A, Camm AJ, Dean V, Deckers JW, Despres C, Dickstein K, Lekakis J, McGregor K, Metra M, Morais J, Osterspey A, Tamargo JL, Zamorano JL, American College of Cardiology, American Heart Association Task Force, European Society of Cardiology Committee for Practice Guidelines. ACC/AHA/ESC 2006 guidelines for management of patients with ventricular arrhythmias and the prevention of sudden cardiac death: a report of the American College of Cardiology/American Heart Association Task Force and the European Society [trunc]. J Am Coll Cardiol 2006 Sep 5;48(5):e247-346. [1085 references] [PubMed](#)

### GUIDELINE STATUS

This is the current release of the guideline.

### \*\* REGULATORY ALERT \*\*

### FDA WARNING/REGULATORY ALERT

**Note from the National Guideline Clearinghouse:** This guideline references a drug(s)/intervention(s) for which important revised regulatory and/or warning information has been released.

- [June 8, 2007, Troponin-I Immunoassay](#): Class I Recall of all lots of the Architect Stat Troponin-I Immunoassay. The assay may report falsely elevated or falsely decreased results at and near a low level, which may impact patient treatment.

## COMPLETE SUMMARY CONTENT

\*\* REGULATORY ALERT \*\*

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INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT

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## SCOPE

### DISEASE/CONDITION(S)

- Ventricular arrhythmias
- Sudden cardiac death

### GUIDELINE CATEGORY

Diagnosis  
Evaluation  
Management  
Prevention  
Risk Assessment  
Treatment

### CLINICAL SPECIALTY

Cardiology  
Emergency Medicine  
Family Practice  
Internal Medicine

### INTENDED USERS

Physicians

### GUIDELINE OBJECTIVE(S)

- To update and combine the previously published recommendations into one source approved by the major cardiology organizations in the United States and Europe
- To produce guidelines that improve the effectiveness of care, optimize patient outcomes, and affect the overall cost of care favorably by focusing resources on the most effective strategies

## **TARGET POPULATION**

- Patients with ventricular arrhythmias
- Patients at risk for ventricular arrhythmias or sudden cardiac "death" episodes

## **INTERVENTIONS AND PRACTICES CONSIDERED**

### **Diagnosis/Evaluation**

1. History and physical examination
2. Resting electrocardiogram (ECG)
3. Exercise testing
4. Ambulatory electrocardiography
5. Electrocardiographic techniques and measurements (T wave alternans, signal-averaged electrocardiogram (SAECG), heart rate variability (HRV), baroreflex sensitivity and heart rate turbulence)
6. Electrophysiological testing
7. Left ventricular function and imaging
  - Echocardiograph
  - Exercise testing with an imaging modality (echocardiography or nuclear perfusion [single-photon emission computed tomography (SPECT)])
  - Cardiac magnetic resonance imaging
  - Cardiac computed tomography
  - Radionuclide angiography
  - Coronary angiography

### **Management/Treatment**

1. Cardiopulmonary resuscitation
2. Automated external defibrillation
3. Management of causes and factors contributing to cardiac arrest (electrolyte disturbances, mechanical factors, volume depletion)
4. Direct current cardioversion
5. Transvenous catheter placement
6. Pharmacologic treatment
  - Antiarrhythmic agents (e.g. amiodarone, procainamide, lidocaine, sotalol, quinidine, mexiletine)
  - Isoproterenol
  - Calcium channel blockers
  - Potassium and magnesium salts
  - Antidigitalis antibodies
7. Acute and long term pacing
8. Overdrive pacing
9. Spinal cord modulation
10. Left cardiac sympathetic denervation
11. Coronary revascularization
12. Implantation of an implantable cardioverter defibrillator (ICD)
13. Adjunct treatments for ICD (catheter ablation, surgical resection, pharmacological therapy)
14. Lifestyle modification
15. Management of comorbid conditions

16. Ventricular arrhythmias and sudden cardiac death related to specific populations

- Athletes
- Gender and pregnancy
- Elderly patients
- Pediatric patients
- Patients with ICDs
- Drug-induced arrhythmias

**MAJOR OUTCOMES CONSIDERED**

- Restoration and maintenance of sinus rhythm
- Successful ablation of ectopic focus
- Hemodynamic function
- Quality of life
- Adverse effects of treatment (e.g., antiarrhythmia drug toxicities)
- Prevention of cardiac arrest
- Successful resuscitation of cardiac arrest
- Mortality rate

**METHODOLOGY**

**METHODS USED TO COLLECT/SELECT EVIDENCE**

Searches of Electronic Databases

**DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE**

The committee conducted comprehensive searching of the scientific and medical literature on ventricular arrhythmias and sudden cardiac death (SCD). Literature searching was limited to publications on humans and in English from 1990 to 2006. The search parameters were extended for selected topics when a historical reference was needed or if limited studies existed in English. In addition to broad-based searching on ventricular arrhythmias and SCD, specific targeted searches were performed on ventricular arrhythmias and SCD and the following subtopics: mechanisms, substrates, clinical presentations, electrocardiogram, exercise testing, echocardiography, imaging, electrophysiological testing, drug therapy (antiarrhythmic and nonantiarrhythmic), implantable and external cardioverter devices, ablation, surgery, acute specific arrhythmias (e.g., acute coronary syndrome, heart failure, stable sustained monomorphic ventricular tachycardia, torsades de pointes), specific pathology (e.g., congenital heart disease, myocarditis, endocrine disorders, renal failure), cardiomyopathies, genetic arrhythmias, structurally normal hearts, athletes, elderly, gender, pediatric, and drug-induced arrhythmias. The complete list of keywords is beyond the scope of this section. The committee reviewed all compiled reports from computerized searches and conducted additional manual searching. Literature citations were generally restricted to published manuscripts appearing in journals in the Index Medicus. Because of the scope and importance of certain ongoing clinical trials and other emerging information, published abstracts were cited in the text when they were the only published information available.

## **NUMBER OF SOURCE DOCUMENTS**

Not stated

## **METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE**

Weighting According to a Rating Scheme (Scheme Given)

## **RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE**

### **Levels of Evidence**

- **Level of Evidence A:** Data derived from multiple randomized clinical trials or meta-analyses.
- **Level of Evidence B:** Data derived from a single randomized trial, or nonrandomized studies.
- **Level of Evidence C:** Only consensus opinion of experts, case studies, or standard-of-care.

## **METHODS USED TO ANALYZE THE EVIDENCE**

Review of Published Meta-Analyses  
Systematic Review with Evidence Tables

## **DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE**

Not stated

## **METHODS USED TO FORMULATE THE RECOMMENDATIONS**

Expert Consensus

## **DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS**

Writing Committee members were selected with attention to cardiovascular subspecialties, broad geographical representation, and involvement in academic medicine and clinical practice. The Writing Committee on the Management of Patients With Ventricular Arrhythmias and Prevention of Sudden Cardiac Death also included members of the American College of Cardiology (ACC)/ American Heart Association (AHA) Task Force on Practice Guidelines, European Society of Cardiology (ESC) Committee on Practice Guidelines, ACC Board of Trustees, ACC Board of Governors, ESC Board, the European Heart Rhythm Association (EHRA), and the Heart Rhythm Society (HRS).

The schema for classification of recommendations and level of evidence is summarized in Table 2 of the original full length guideline document, which also illustrates how the grading system provides an estimate of the size of treatment effect and an estimate of the certainty of the treatment effect.

Recommendations with respect to therapy have considered the following:

1. The therapy to be offered (implantable cardioverter defibrillator [ICD], antiarrhythmic drugs, surgery, and miscellaneous other treatments)
2. The point at which therapy is offered (primary prevention for those who are at risk but have not yet had a life-threatening ventricular arrhythmia or sudden cardiac "death" episode, or secondary for those patients who have already experienced such arrhythmias or events)
3. The purpose of therapy (life preservation or symptom reduction/improved quality of life)
4. The etiology of the arrhythmia substrate (coronary heart disease [CHD], cardiomyopathy, or other conditions)
5. The functional status of the patient (New York Heart Association [NYHA] functional class)
6. The state of left ventricular (LV) function (LV ejection fraction [LVEF])
7. The specific arrhythmia concerned (e.g., sustained monomorphic VT, polymorphic VT, and ventricular fibrillation [VF])

Not all therapeutic combinations are clinically relevant, and many have no evidence base and probably will not have one in the future because of the lack of clinical relevance or the relative rarity of the particular grouping. In many instances, the probable value of therapy may be reasonably inferred by the response of similar patients to specific therapies.

Recommendations for prophylactic ICD implantation based on ejection fractions (EFs) have been inconsistent because clinical investigators have chosen different EFs for enrollment in trials of therapy, average values of the EF in such trials have been substantially lower than the cutoff value for enrollment, and subgroup analyses of clinical trial populations based on EF have not been consistent in their implications. Substantial differences between guidelines have resulted. However, no trial has randomized patients with an intermediate range of EFs. For instance, there is no trial that has specifically studied patients with an LVEF between 31% and 35%, yet recommendations have been set for such patients on the basis of data derived from trials that studied groups with EFs less than or equal to 30%, others that enrolled patients with an EF less than or equal to 35%, and one trial that enrolled patients with an EF less than or equal to 40%. Recognizing these inconsistencies, this Guideline Writing Committee decided to construct recommendations to apply to patients with an EF less than or equal to a range of values. The highest appropriate class of recommendation was then based on all trials that recruited patients with EFs within this range. In this way, potential conflicts between guidelines were reduced and errors due to drawing false conclusions relating to unstudied patient groups were minimized (see Table 3 in the original full-length guideline document).

## **RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS**

### **Classification of Recommendations**

- **Class I:** Conditions for which there is evidence and/or general agreement that a given procedure/treatment is beneficial, useful, and effective.

- **Class II:** Conditions for which there is conflicting evidence and/or a divergence of opinion about the usefulness/efficacy of a procedure or treatment.
  - **Class IIa:** Weight of evidence/opinion is in favor of usefulness/efficacy.
  - **Class IIb:** Usefulness/efficacy is less well established by evidence/opinion.
- **Class III:** Conditions for which there is evidence and/or general agreement that a procedure/treatment is not useful or effective and in some cases may be harmful.

## COST ANALYSIS

Published cost analyses were reviewed.

## METHOD OF GUIDELINE VALIDATION

External Peer Review

Internal Peer Review

## DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

The document was reviewed by 2 official reviewers nominated by the American College of Cardiology (ACC), 2 official reviewers nominated by the American Heart Association (AHA), 2 official reviewers nominated by the European Society of Cardiology (ESC), 1 official reviewer from the ACC/AHA Task Force on Practice Guidelines, reviewers from the European Heart Rhythm Association (EHRA) and Heart Rhythm Society (HRS), and 18 content reviewers, including members from American College of Cardiology Foundation (ACCF) Clinical Electrophysiology Committee, AHA Council on Clinical Cardiology, Electrocardiography, and Arrhythmias, and AHA Advanced Cardiac Life Support Subcommittee.

## RECOMMENDATIONS

### MAJOR RECOMMENDATIONS

Definitions for the weight of the evidence (A-C) and classes of recommendations (I-III) can be found at the end of the "Major Recommendations" field.

### **Classification of Ventricular Arrhythmias and Sudden Cardiac Death**

This classification table is provided for direction and introduction of the guidelines.

**Table. Classification of Ventricular Arrhythmias**

Classification by Clinical Presentation		
Hemodynamically stable	Asymptomatic	The absence of symptoms that could result from an arrhythmia
	Minimal symptoms (e.g. palpitations)	Patient reports palpitations felt in either the chest, throat, or neck as described by the

		<p>following:</p> <ul style="list-style-type: none"> <li>• Heartbeat sensations that feel like pounding or racing</li> <li>• An unpleasant awareness of heartbeat</li> <li>• Feeling skipped beats or a pause</li> </ul>
Hemodynamically unstable	Presyncope	<p>Patient reports presyncope as described by the following:</p> <ul style="list-style-type: none"> <li>• Dizziness</li> <li>• Lightheadedness</li> <li>• Feeling faint</li> <li>• "Graying out"</li> </ul>
	Syncope	Sudden loss of consciousness with loss of postural tone not related to anesthesia, with spontaneous recovery as reported by the patient or observer. Patient may experience syncope when supine
	Sudden cardiac death	Death from an unexpected circulatory arrest, usually due to a cardiac arrhythmia occurring within an hour of the onset of symptoms
	Sudden cardiac arrest	Death from an unexpected circulatory arrest, usually due to a cardiac arrhythmia occurring within an hour of the onset of symptoms, in whom medical intervention (e.g., defibrillation) reverses the event
<b>Classification by Electrocardiography</b>		
Nonsustained VT		<p>Three or more beats in duration, terminating spontaneously in less than 30 seconds</p> <p>VT is a cardiac arrhythmia of three or more consecutive complexes in duration emanating from the ventricles at a rate of greater than 100 bpm (cycle length less than 600 ms)</p>
	Monomorphic	Nonsustained VT with a single QRS morphology.
	Polymorphic	Nonsustained VT with a changing QRS morphology at cycle length between 600 and 180 ms
Sustained VT		VT greater than 30 s in duration and/or requiring termination due to hemodynamic compromise in less than 30 s.
	Monomorphic	Sustained VT with a stable single QRS morphology
	Polymorphic	Sustained VT with a changing or multiform QRS morphology at cycle length between 600 and 180 ms
Bundle-branch re-		VT due to re-entry involving the His-Purkinje



entrant tachycardia		system, usually with LBBB morphology; this usually occurs in the setting of cardiomyopathy
Bidirectional VT		VT with a beat-to-beat alternans in the QRS frontal plane axis, often associated with digitalis toxicity.
Torsades de pointes		<p>Characterized by VT associated with a long QT or QTc, and electrocardiographically characterized by twisting of the peaks of the QRS complexes around the isoelectric line during the arrhythmia:</p> <ul style="list-style-type: none"> <li>• "Typical," initiated following "short-long-short" coupling intervals.</li> <li>• Short coupled variant initiated by normal-short coupling.</li> </ul>
Ventricular flutter		A regular (cycle length variability 30 ms or less) ventricular arrhythmia approximately 300 bpm (cycle length—200 ms) with a monomorphic appearance; no isoelectric interval between successive QRS complexes.
Ventricular fibrillation		Rapid, usually more than 300 bpm/200 ms (cycle length 180 ms or less), grossly irregular ventricular rhythm with marked variability in QRS cycle length, morphology, and amplitude.
<b>Classification by Disease Entity</b>		
Chronic coronary heart disease		
Heart failure		
Congenital heart disease		
Neurological disorders		
Structurally normal hearts		
Sudden infant death syndrome		
Cardiomyopathies	Dilated cardiomyopathy	
	Hypertrophic cardiomyopathy	
	Arrhythmogenic right ventricular cardiomyopathy	

bpm = beats per minutes; LBBB = left bundle-branch block; ms = milliseconds; s = seconds; VT = ventricular tachycardia.

## **Clinical Presentations of Patients with Ventricular Arrhythmias and Sudden Cardiac Death**

Ventricular arrhythmias can occur in individuals with or without cardiac disorders. There is a great deal of overlap between clinical presentations (see Table below titled "Clinical Presentations of Patients With Ventricular Arrhythmias and Sudden Cardiac Death") and severity and type of heart disease. For example, stable and well-tolerated ventricular tachycardia (VT) can occur in the individual with previous myocardial infarction (MI) and impaired ventricular function. The prognosis and management are individualized according to symptom burden and severity of underlying heart disease in addition to the clinical presentation.

**Table. Clinical Presentations of Patients With Ventricular Arrhythmias and Sudden Cardiac Death**

- Asymptomatic individuals with or without electrocardiographic abnormalities
- Persons with symptoms potentially attributable to ventricular arrhythmias
  - Palpitations
  - Dyspnea
  - Chest pain
  - Syncope and presyncope
- Ventricular tachycardia that is hemodynamically stable
- Ventricular tachycardia that is not hemodynamically stable
- Cardiac arrest
  - Asystole (sinus arrest, atrioventricular block)
  - Ventricular tachycardia
  - Ventricular fibrillation
  - Pulseless electrical activity

## **Resting Electrocardiography**

### *Class I*

Resting 12-lead electrocardiogram (ECG) is indicated in all patients who are evaluated for ventricular arrhythmias. (*Level of Evidence: A*)

## **Exercise Testing**

### *Class I*

1. Exercise testing is recommended in adult patients with ventricular arrhythmias who have an intermediate or greater probability of having coronary heart disease (CHD) by age, gender, and symptoms\* to provoke ischemic changes or ventricular arrhythmias. (*Level of Evidence: B*) \*See Table 4 in the "ACC/AHA 2002 Guideline Update for Exercise Testing" for further explanation of CHD probability. (See "Availability of Companion Documents" field in this summary)
2. Exercise testing, regardless of age, is useful in patients with known or suspected exercise-induced ventricular arrhythmias, including

catecholaminergic VT, to provoke the arrhythmia, achieve a diagnosis, and determine the patient's response to tachycardia. (*Level of Evidence: B*)

#### *Class IIa*

Exercise testing can be useful in evaluating response to medical or ablation therapy in patients with known exercise-induced ventricular arrhythmias. (*Level of Evidence: B*)

#### *Class IIb*

1. Exercise testing may be useful in patients with ventricular arrhythmias and a low probability of CHD by age, gender, and symptoms.\* (*Level of Evidence: C*) \*See Table 4 in the "ACC/AHA 2002 Guideline Update for Exercise Testing" for further explanation of CHD probability. (See "Availability of Companion Documents" field in this summary)
2. Exercise testing may be useful in the investigation of isolated premature ventricular complexes (PVCs) in middle-aged or older patients without other evidence of CHD. (*Level of Evidence: C*)

#### *Class III*

See Table 1 in the "ACC/AHA 2002 Guideline Update for Exercise Testing" for contraindications. (*Level of Evidence: B*) (See "Availability of Companion Documents" field in this summary)

### **Ambulatory Electrocardiography**

#### *Class I*

1. Ambulatory electrocardiogram (ECG) is indicated when there is a need to clarify the diagnosis by detecting arrhythmias, QT interval changes, T-wave alternans (TWA), or ST changes, to evaluate risk, or to judge therapy. (*Level of Evidence: A*)
2. Event monitors are indicated when symptoms are sporadic to establish whether or not they are caused by transient arrhythmias. (*Level of Evidence: B*)
3. Implantable recorders are useful in patients with sporadic symptoms suspected to be related to arrhythmias such as syncope when a symptom-rhythm correlation cannot be established by conventional diagnostic techniques. (*Level of Evidence: B*)

### **Electrocardiographic Techniques and Measurements**

#### *Class IIa*

It is reasonable to use TWA to improve the diagnosis and risk stratification of patients with ventricular arrhythmias or who are at risk for developing life threatening ventricular arrhythmias. (*Level of Evidence: A*)

#### *Class IIb*

ECG techniques such as signal-averaged ECG (SAECG), heart rate variability (HRV), baroflex sensitivity, and heart rate turbulence may be useful to improve the diagnosis and risk stratification of patients with ventricular arrhythmias or who are at risk of developing life threatening ventricular arrhythmias. (*Level of Evidence: B*)

### **Left Ventricular Function and Imaging**

#### *Class I*

1. Echocardiography is recommended in patients with ventricular arrhythmias who are suspected of having structural heart disease. (*Level of Evidence: B*)
2. Echocardiography is recommended for the subset of patients at high risk for the development of serious ventricular arrhythmias or sudden cardiac death (SCD), such as those with dilated, hypertrophic, or right ventricular (RV) cardiomyopathies, acute myocardial infarction (AMI) survivors, or relatives of patients with inherited disorders associated with SCD. (*Level of Evidence: B*)
3. Exercise testing with an imaging modality (echocardiography or nuclear perfusion [single-photon emission computed tomography (SPECT)]) is recommended to detect silent ischemia in patients with ventricular arrhythmias who have an intermediate probability of having CHD by age, symptoms, and gender and in whom ECG assessment is less reliable because of digoxin use, left ventricular hypertrophy (LVH), greater than 1-mm ST-segment depression at rest, Wolff-Parkinson-White (WPW) syndrome, or left bundle branch block (LBBB). (*Level of Evidence: B*)
4. Pharmacological stress testing with an imaging modality (echocardiography or myocardial perfusion SPECT) is recommended to detect silent ischemia in patients with ventricular arrhythmias who have an intermediate probability of having CHD by age, symptoms, and gender and are physically unable to perform a symptom-limited exercise test. (*Level of Evidence: B*)

#### *Class IIa*

1. Magnetic resonance imaging (MRI), cardiac computed tomography (CT), or radionuclide angiography can be useful in patients with ventricular arrhythmias when echocardiography does not provide accurate assessment of left ventricular (LV) and RV function and/or evaluation of structural changes. (*Level of Evidence: B*)
2. Coronary angiography can be useful in establishing or excluding the presence of significant obstructive CHD in patients with life-threatening ventricular arrhythmias or in survivors of SCD, who have an intermediate or greater probability of having CHD by age, symptoms, and gender. (*Level of Evidence: C*)
3. LV imaging can be useful in patients undergoing biventricular pacing. (*Level of Evidence: C*)

### **Electrophysiological (EP) Testing**

#### **Electrophysiological Testing in Patients with Coronary Heart Disease**

#### *Class I*

1. EP testing is recommended for diagnostic evaluation of patients with remote MI with symptoms suggestive of ventricular tachyarrhythmias, including palpitations, presyncope, and syncope. (*Level of Evidence: B*)
2. EP testing is recommended in patients with CHD to guide and assess the efficacy of VT ablation. (*Level of Evidence: B*)
3. EP testing is useful in patients with CHD for the diagnostic evaluation of wide-QRS-complex tachycardias of unclear mechanism. (*Level of Evidence: C*)

#### *Class IIa*

EP testing is reasonable for risk stratification in patients with remote MI, Nonsustained ventricular tachycardia (NSVT), and LV ejection fraction equal to or less than 40%. (*Level of Evidence: B*)

### **Electrophysiological Testing in Patients with Syncope**

#### *Class I*

EP testing is recommended in patients with syncope of unknown cause with impaired LV function or structural heart disease. (*Level of Evidence: B*)

#### *Class IIa*

EP testing can be useful in patients with syncope when bradyarrhythmias or tachyarrhythmias are suspected and in whom noninvasive diagnostic studies are not conclusive. (*Level of Evidence: B*)

### **Implantable and External Cardioverter Devices**

#### **Ablation**

#### *Class I*

1. Ablation is indicated in patients who are otherwise at low risk for SCD and have sustained predominantly monomorphic VT that is drug resistant, who are drug intolerant, or who do not wish long-term drug therapy. (*Level of Evidence: C*)
2. Ablation is indicated in patients with bundle-branch reentrant VT. (*Level of Evidence: C*)
3. Ablation is indicated as adjunctive therapy in patients with an ICD who are receiving multiple shocks as a result of sustained VT that is not manageable by reprogramming or changing drug therapy or who do not wish long-term drug therapy. (*Level of Evidence: C*)
4. Ablation is indicated in patients with WPW syndrome resuscitated from sudden cardiac arrest due to atrial fibrillation (AF) and rapid conduction over the accessory pathway causing ventricular fibrillation (VF). (*Level of Evidence: B*)

#### *Class IIa*

1. Ablation can be useful therapy in patients who are otherwise at low risk for SCD and have symptomatic nonsustained monomorphic VT that is drug resistant, who are drug intolerant or who do not wish long-term drug therapy. (*Level of Evidence: C*)
2. Ablation can be useful therapy in patients who are otherwise at low risk for SCD and have frequent symptomatic predominantly monomorphic PVCs that are drug resistant or who are drug intolerant or who do not wish long-term drug therapy. (*Level of Evidence: C*)
3. Ablation can be useful in symptomatic patients with WPW syndrome who have accessory pathways with refractory periods less than 240 milliseconds (ms) in duration. (*Level of Evidence: B*)

#### *Class IIb*

1. Ablation of Purkinje fiber potentials may be considered in patients with ventricular arrhythmia storm consistently provoked by PVCs of similar morphology. (*Level of Evidence: C*)
2. Ablation of asymptomatic PVCs may be considered when the PVCs are very frequent to avoid or treat tachycardia-induced cardiomyopathy. (*Level of Evidence: C*)

#### *Class III*

Ablation of asymptomatic relatively infrequent PVCs is not indicated. (*Level of Evidence: C*)

### **Acute Management of Specific Arrhythmias**

#### **Management of Cardiac Arrest**

##### *Class I*

1. After establishing the presence of definite, suspected, or impending cardiac arrest, the first priority should be activation of a response team capable of identifying the specific mechanism and carrying out prompt intervention. (*Level of Evidence: B*)
2. Cardiopulmonary resuscitation (CPR) should be implemented immediately after contacting a response team. (*Level of Evidence: A*)
3. In an out-of-hospital setting, if an automated external defibrillator (AED) is available, it should be applied immediately and shock therapy administered according to the algorithms contained in the documents on CPR developed by the AHA in association with the International Liaison Committee on Resuscitation (ILCOR) and/or the European Resuscitation Council (ERC). (*Level of Evidence: C*)
4. For victims with ventricular tachyarrhythmic mechanisms of cardiac arrest, when recurrences occur after a maximally defibrillating shock (generally 360 joules (J) for monophasic defibrillators), intravenous amiodarone should be the preferred antiarrhythmic drug for attempting a stable rhythm after further defibrillations. (*Level of Evidence: B*)
5. For recurrent ventricular tachyarrhythmias or non-tachyarrhythmic mechanisms of cardiac arrest, it is recommended to follow the algorithms

contained in the documents on CPR developed by the AHA in association with ILCOR and/or the ERC. (*Level of Evidence: C*)

6. Reversible causes and factors contributing to cardiac arrest should be managed during advanced life support, including management of hypoxia, electrolyte disturbances, mechanical factors, and volume depletion. (*Level of Evidence: C*)

#### *Class IIa*

For response times greater than or equal to 5 minutes, a brief (less than 90 to 180 seconds) period of CPR is reasonable prior to attempting defibrillation. (*Level of Evidence: B*)

#### *Class IIb*

A single precordial thump may be considered by health care professional providers when responding to a witnessed cardiac arrest. (*Level of Evidence: C*)

### **Ventricular Tachycardia Associated With Low Troponin Myocardial Infarction**

#### *Class I*

Patients presenting with sustained VT in whom low-level elevations in cardiac biomarkers of myocyte injury/necrosis are documented should be treated similarly to patients who have sustained VT and in whom no biomarker rise is documented. (*Level of Evidence: C*)

### **Sustained Monomorphic Ventricular Tachycardia**

#### *Class I*

1. Wide-QRS tachycardia should be presumed to be VT if the diagnosis is unclear. (*Level of Evidence: C*)
2. Direct current cardioversion with appropriate sedation is recommended at any point in the treatment cascade in patients with suspected sustained monomorphic VT with hemodynamic compromise. (*Level of Evidence: C*)

#### *Class IIa*

1. Intravenous procainamide (or ajmaline in some European countries) is reasonable for initial treatment of patients with stable sustained monomorphic VT. (*Level of Evidence: B*)
2. Intravenous amiodarone is reasonable in patients with sustained monomorphic VT that is hemodynamically unstable, refractory to conversion with countershock, or recurrent despite procainamide or other agents. (*Level of Evidence: C*)
3. Transvenous catheter pace termination can be useful to treat patients with sustained monomorphic VT that is refractory to cardioversion or is frequently recurrent despite antiarrhythmic medication. (*Level of Evidence: C*)

### *Class IIb*

Intravenous lidocaine might be reasonable for the initial treatment of patients with stable sustained monomorphic VT specifically associated with acute myocardial ischemia or infarction. (*Level of Evidence: C*)

### *Class III*

Calcium channel blockers such as verapamil and diltiazem should not be used in patients to terminate wide-QRS-complex tachycardia of unknown origin, especially in patients with a history of myocardial dysfunction. (*Level of Evidence: C*)

## **Repetitive Monomorphic Ventricular Tachycardia**

### *Class IIa*

Intravenous amiodarone, beta blockers, and intravenous procainamide (or sotalol or ajmaline in Europe) can be useful for treating repetitive monomorphic VT in the context of coronary disease and idiopathic VT. (*Level of Evidence: C*)

## **Polymorphic VT**

### *Class I*

1. Direct current cardioversion with appropriate sedation as necessary is recommended for patients with sustained polymorphic VT with hemodynamic compromise and is reasonable at any point in the treatment cascade. (*Level of Evidence: B*)
2. Intravenous beta blockers are useful for patients with recurrent polymorphic VT, especially if ischemia is suspected or cannot be excluded. (*Level of Evidence: B*)
3. Intravenous loading with amiodarone is useful for patients with recurrent polymorphic VT in the absence of abnormal repolarization related to congenital or acquired LQTS. (*Level of Evidence: C*)
4. Urgent angiography with a view to revascularization should be considered for patients with polymorphic VT when myocardial ischemia cannot be excluded. (*Level of Evidence: C*)

### *Class IIb*

Intravenous lidocaine may be reasonable for treatment of polymorphic VT specifically associated with acute myocardial ischemia or infarction. (*Level of Evidence: C*)

## **Torsades de Pointes**

### *Class I*

1. Withdrawal of any offending drugs and correction of electrolyte abnormalities are recommended in patients presenting with torsades de pointes. (*Level of Evidence: A*)



2. Acute and long-term pacing is recommended for patients presenting with torsades de pointes due to heart block and symptomatic bradycardia. (*Level of Evidence: A*)

#### *Class IIa*

1. Management with intravenous magnesium sulfate is reasonable for patients who present with LQTS and few episodes of torsades de pointes. Magnesium is not likely to be effective in patients with a normal QT interval. (*Level of Evidence: B*)
2. Acute and long-term pacing is reasonable for patients who present with recurrent pause-dependent torsades de pointes. (*Level of Evidence: B*)
3. Beta blockade combined with pacing is reasonable acute therapy for patients who present with torsades de pointes and sinus bradycardia. (*Level of Evidence: C*)
4. Isoproterenol is reasonable as temporary treatment in acute patients who present with recurrent pause-dependent torsades de pointes who do not have congenital LQTS. (*Level of Evidence: B*)

#### *Class IIb*

1. Potassium repletion to 4.5 to 5 mmol/L may be considered for patients who present with torsades de pointes. (*Level of Evidence: B*)
2. Intravenous lidocaine or oral mexiletine may be considered in patients who present with LQT3 and torsades de pointes. (*Level of Evidence: C*)

### **Incessant Ventricular Tachycardia**

#### *Class I*

Revascularization and beta blockade followed by intravenous antiarrhythmic drugs such as procainamide or amiodarone are recommended for patients with recurrent or incessant polymorphic VT due to acute myocardial ischemia. (*Level of Evidence: C*)

#### *Class IIa*

Intravenous amiodarone or procainamide followed by VT ablation can be effective in the management of patients with frequently recurring or incessant monomorphic VT. (*Level of Evidence: B*)

#### *Class IIb*

1. Intravenous amiodarone and intravenous beta blockers separately or together may be reasonable in patients with VT storm. (*Level of Evidence: C*)
2. Overdrive pacing or general anesthesia may be considered for patients with frequently recurring or incessant VT. (*Level of Evidence: C*)
3. Spinal cord modulation may be considered for some patients with frequently recurring or incessant VT. (*Level of Evidence: C*)

## **Ventricular Arrhythmia and Sudden Cardiac Death Related to Specific Pathology**

### **Left Ventricular Dysfunction Due to Prior Myocardial Infarction**

#### *Class I*

1. Aggressive attempts should be made to treat heart failure (HF) that may be present in some patients with LV dysfunction due to prior MI and ventricular tachyarrhythmias. (*Level of Evidence: C*)
2. Aggressive attempts should be made to treat myocardial ischemia that may be present in some patients with ventricular tachyarrhythmias. (*Level of Evidence: C*)
3. Coronary revascularization is indicated to reduce the risk of SCD in patients with VF when direct, clear evidence of acute myocardial ischemia is documented to immediately precede the onset of VF. (*Level of Evidence: B*)
4. If coronary revascularization cannot be carried out and there is evidence of prior MI and significant LV dysfunction, the primary therapy of patients resuscitated from VF should be the implantable cardioverter defibrillator (ICD) in patients who are receiving chronic optimal medical therapy and those who have reasonable expectation of survival with a good functional status for more than 1 year. (*Level of Evidence: A*)
5. ICD therapy is recommended for primary prevention to reduce total mortality by a reduction in SCD in patients with LV dysfunction due to prior MI who are at least 40 days post-MI, have an LVEF less than or equal to 30% to 40%, are New York Heart Association (NYHA) functional class II or III, are receiving chronic optimal medical therapy, and who have reasonable expectation of survival with a good functional status for more than 1 year. (*Level of Evidence: A*) (See Section 1.2 in the original full-text guideline document.)
6. The ICD is effective therapy to reduce mortality by a reduction in SCD in patients with LV dysfunction due to prior MI who present with hemodynamically unstable sustained VT, are receiving chronic optimal medical therapy, and who have reasonable expectation of survival with a good functional status for more than 1 year. (*Level of Evidence: A*)

#### *Class IIa*

1. Implantation of an ICD is reasonable in patients with LV dysfunction due to prior MI who are at least 40 days post-MI, have an LVEF of less than or equal to 30% to 35%, are NYHA functional class I on chronic optimal medical therapy, and who have reasonable expectation of survival with a good functional status for more than 1 y. (*Level of Evidence: B*) (See Section 1.2 in the original full-text guideline document)
2. Amiodarone, often in combination with beta blockers, can be useful for patients with LV dysfunction due to prior MI and symptoms due to VT unresponsive to beta-adrenergic- blocking agents. (*Level of Evidence: B*)
3. Sotalol is reasonable therapy to reduce symptoms resulting from VT for patients with LV dysfunction due to prior MI unresponsive to beta-blocking agents. (*Level of Evidence: C*)
4. Adjunctive therapies to the ICD, including catheter ablation or surgical resection, and pharmacological therapy with agents such as amiodarone or sotalol are reasonable to improve symptoms due to frequent episodes of

- sustained VT or VF in patients with LV dysfunction due to prior MI. (*Level of Evidence: C*)
5. Amiodarone is reasonable therapy to reduce symptoms due to recurrent hemodynamically stable VT for patients with LV dysfunction due to prior MI who cannot or refuse to have an ICD implanted. (*Level of Evidence: C*)
  6. Implantation is reasonable for treatment of recurrent ventricular tachycardia in patients post-MI with normal or near normal ventricular function who are receiving chronic optimal medical therapy and who have reasonable expectation of survival with a good functional status for more than 1 year. (*Level of Evidence: C*)

#### *Class IIb*

1. Curative catheter ablation or amiodarone may be considered in lieu of ICD therapy to improve symptoms in patients with LV dysfunction due to prior MI and recurrent hemodynamically stable VT whose LVEF is greater than 40%. (*Level of Evidence: B*)
2. Amiodarone may be reasonable therapy for patients with LV dysfunction due to prior MI with an ICD indication, as defined above, in patients who cannot or refuse to have an ICD implanted. (*Level of Evidence: C*)

#### *Class III*

1. Prophylactic antiarrhythmic drug therapy is not indicated to reduce mortality in patients with asymptomatic nonsustained ventricular arrhythmias. (*Level of Evidence: B*)
2. Class IC antiarrhythmic drugs in patients with a past history of MI should not be used. (*Level of Evidence: A*)

### **Valvular Heart Disease**

#### *Class I*

Patients with valvular heart disease and ventricular arrhythmias should be evaluated and treated following current recommendations for each disorder. (*Level of Evidence: C*)

#### *Class IIb*

The effectiveness of mitral valve repair or replacement to reduce the risk of SCD in patients with mitral valve prolapse, severe mitral regurgitation, and serious ventricular arrhythmias is not well established. (*Level of Evidence: C*)

### **Congenital Heart Disease**

#### *Class I*

1. ICD implantation is indicated in patients with congenital heart disease who are survivors of cardiac arrest after evaluation to define the cause of the event and exclude any reversible causes. ICD implantation is indicated in patients who are receiving chronic optimal medical therapy and who have

- reasonable expectation of survival with a good functional status for more than 1 year. (*Level of Evidence: B*)
2. Patients with congenital heart disease and spontaneous sustained VT should undergo invasive hemodynamic and EP evaluation. Recommended therapy includes catheter ablation or surgical resection to eliminate VT. If that is not successful, ICD implantation is recommended. (*Level of Evidence: C*)

#### *Class IIa*

Invasive hemodynamic and EP evaluation is reasonable in patients with congenital heart disease and unexplained syncope and impaired ventricular function. In the absence of a defined and reversible cause, ICD implantation is reasonable in patients who are receiving chronic optimal medical therapy and who have reasonable expectation of survival with a good functional status for more than 1 year (*Level of Evidence: B*)

#### *Class IIb*

EP testing may be considered for patients with congenital heart disease and ventricular couplets or NSVT to determine the risk of a sustained ventricular arrhythmia. (*Level of Evidence: C*)

#### *Class III*

Prophylactic antiarrhythmic therapy is not indicated for asymptomatic patients with congenital heart disease and isolated PVCs. (*Level of Evidence: C*)

### **Metabolic and Inflammatory Conditions**

#### *Myocarditis, Rheumatic Disease, and Endocarditis*

#### *Class I*

1. Temporary pacemaker insertion is indicated in patients with symptomatic bradycardia and/or heart block during the acute phase of myocarditis. (*Level of Evidence: C*)
2. Acute aortic regurgitation associated with VT should be treated surgically unless otherwise contraindicated. (*Level of Evidence: C*)
3. Acute endocarditis complicated by aortic or annular abscess and atrioventricular (AV) block should be treated surgically unless otherwise contraindicated. (*Level of Evidence: C*)

#### *Class IIa*

1. ICD implantation can be beneficial in patients with life-threatening ventricular arrhythmias who are not in the acute phase of myocarditis, who are receiving chronic optimal medical therapy, and who have reasonable expectation of survival with a good functional status for more than 1 year. (*Level of Evidence: C*)
2. Antiarrhythmic therapy can be useful in patients with symptomatic NSVT or sustained VT during the acute phase of myocarditis. (*Level of Evidence: C*)

### *Class III*

ICD implantation is not indicated during the acute phase of myocarditis. (*Level of Evidence: C*)

### *Infiltrative Cardiomyopathies*

#### *Class I*

In addition to managing the underlying infiltrative cardiomyopathy, life-threatening arrhythmias should be treated in the same manner that such arrhythmias are treated in patients with other cardiomyopathies, including the use of ICD and pacemakers in patients who are receiving chronic optimal medical therapy and who have reasonable expectation of survival with a good functional status for more than 1 year. (*Level of Evidence: C*)

### *Endocrine Disorders and Diabetes*

#### *Class I*

1. The management of ventricular arrhythmias secondary to endocrine disorders should address the electrolyte (potassium, magnesium, and calcium) imbalance and the treatment of the underlying endocrinopathy. (*Level of Evidence: C*)
2. Persistent life-threatening ventricular arrhythmias that develop in patients with endocrine disorders should be treated in the same manner that such arrhythmias are treated in patients with other diseases, including use of ICD and pacemaker implantation as required in those who are receiving chronic optimal medical therapy and who have reasonable expectation of survival with a good functional status for more than 1 year. (*Level of Evidence: C*)
3. Patients with diabetes with ventricular arrhythmias should generally be treated in the same manner as patients without diabetes. (*Level of Evidence: A*)

### *End-Stage Renal Failure*

#### *Class I*

1. The acute management of ventricular arrhythmias in end-stage renal failure should immediately address hemodynamic status and electrolyte (potassium, magnesium, and calcium) imbalance. (*Level of Evidence: C*)
2. Life-threatening ventricular arrhythmias, especially in patients awaiting renal transplantation, should be treated conventionally, including the use of ICD and pacemaker as required, in patients who are receiving chronic optimal medical therapy and who have reasonable expectation of survival with a good functional status for more than 1 year. (*Level of Evidence: C*)

### *Obesity, Dieting, and Anorexia*

#### *Class I*

Life-threatening ventricular arrhythmias in patients with obesity, anorexia, or when dieting should be treated in the same manner that such arrhythmias are treated in patients with other diseases, including ICD and pacemaker implantation as required. Patients receiving ICD implantation should be receiving chronic optimal medical therapy and have reasonable expectation of survival with a good functional status for more than 1 year. (*Level of Evidence: C*)

#### *Class IIa*

Programmed weight reduction in obesity and carefully controlled re-feeding in anorexia can effectively reduce the risk of ventricular arrhythmias and SCD. (*Level of Evidence: C*)

#### *Class III*

Prolonged, unbalanced, very low calorie, semistarvation diets are not recommended; they may be harmful and provoke life-threatening ventricular arrhythmias. (*Level of Evidence: C*)

### **Pericardial Diseases**

#### *Class I*

Ventricular arrhythmias that develop in patients with pericardial disease should be treated in the same manner that such arrhythmias are treated in patients with other diseases including ICD and pacemaker implantation as required. Patients receiving ICD implantation should be receiving chronic optimal medical therapy and have reasonable expectation of survival with a good functional status for more than 1 year. (*Level of Evidence: C*)

### **Pulmonary Arterial Hypertension**

#### *Class III*

Prophylactic antiarrhythmic therapy generally is not indicated for primary prevention of SCD in patients with pulmonary arterial hypertension (PAH) or other pulmonary conditions. (*Level of Evidence: C*)

### **Transient Arrhythmias of Reversible Cause**

#### *Class I*

1. Myocardial revascularization should be performed, when appropriate, to reduce the risk of SCD in patients experiencing cardiac arrest due to VF or polymorphic VT in the setting of acute ischemia or MI. (*Level of Evidence: C*)
2. Unless electrolyte abnormalities are proved to be the cause, survivors of cardiac arrest due to VF or polymorphic VT in whom electrolyte abnormalities are discovered in general should be evaluated and treated in a manner similar to that of cardiac arrest without electrolyte abnormalities. (*Level of Evidence: C*)

3. Patients who experience sustained monomorphic VT in the presence of antiarrhythmic drugs or electrolyte abnormalities should be evaluated and treated in a manner similar to that of patients with VT without electrolyte abnormalities or antiarrhythmic drugs present. Antiarrhythmic drugs or electrolyte abnormalities should not be assumed to be the sole cause of sustained monomorphic VT. (*Level of Evidence: B*)
4. Patients who experience polymorphic VT in association with prolonged QT interval due to antiarrhythmic medications or other drugs should be advised to avoid exposure to all agents associated with QT prolongation. A list of such drugs can be found on the Web site [www.torsades.org](http://www.torsades.org). (*Level of Evidence: B*)

## **Ventricular Arrhythmias Associated with Cardiomyopathies**

### **Dilated Cardiomyopathy (Nonischemic)**

#### *Class I*

1. EP testing is useful to diagnose bundle-branch reentrant tachycardia and to guide ablation in patients with nonischemic dilated cardiomyopathy (DCM). (*Level of Evidence: C*)
2. EP testing is useful for diagnostic evaluation in patients with nonischemic DCM with sustained palpitations, wide-QRS-complex tachycardia, presyncope, or syncope. (*Level of Evidence: C*)
3. An ICD should be implanted in patients with nonischemic DCM and significant LV dysfunction who have sustained VT or VF, are receiving chronic optimal medical therapy, and who have reasonable expectation of survival with a good functional status for more than 1 year. (*Level of Evidence: A*)
4. ICD therapy is recommended for primary prevention to reduce total mortality by a reduction in SCD in patients with nonischemic DCM who have an LV ejection fraction (LVEF) less than or equal to 30% to 35%, are NYHA functional class II or III, who are receiving chronic optimal medical therapy, and who have reasonable expectation of survival with a good functional status for more than 1 year. (*Level of Evidence: B*) (See Section 1.2 in the original full-text guideline document.)

#### *Class IIa*

1. ICD implantation can be beneficial for patients with unexplained syncope, significant LV dysfunction, and nonischemic DCM who are receiving chronic optimal medical therapy and who have reasonable expectation of survival with a good functional status for more than 1 year. (*Level of Evidence: C*)
2. ICD implantation can be effective for termination of sustained VT in patients with normal or near normal ventricular function and nonischemic DCM who are receiving chronic optimal medical therapy and who have reasonable expectation of survival with a good functional status for more than 1 year. (*Level of Evidence: C*)

#### *Class IIb*

1. Amiodarone may be considered for sustained VT or VF in patients with nonischemic DCM. (*Level of Evidence: C*)

2. Placement of an ICD might be considered in patients who have nonischemic DCM, LVEF of less than or equal to 30% to 35%, who are NYHA functional *class I* receiving chronic optimal medical therapy, and who have reasonable expectation of survival with a good functional status for more than 1 year. (*Level of Evidence: C*) (See Section 1.2 in the original full-text guideline document).

## **Hypertrophic Cardiomyopathy (HCM)**

### *Class I*

ICD therapy should be used for treatment in patients with HCM who have sustained VT and/or VF and who are receiving chronic optimal medical therapy and who have reasonable expectation of survival with a good functional status for more than 1 year. (*Level of Evidence: B*)

### *Class IIa*

1. ICD implantation can be effective for primary prophylaxis against SCD in patients with HCM who have 1 or more major risk factor (see Table 7 in the original full-text guideline document) for SCD and who are receiving chronic optimal medical therapy and in patients who have reasonable expectation of survival with a good functional status for more than 1 year. (*Level of Evidence: C*)
2. Amiodarone therapy can be effective for treatment in patients with HCM with a history of sustained VT and/or VF when an ICD is not feasible. (*Level of Evidence: C*)

### *Class IIb*

1. EP testing may be considered for risk assessment for SCD in patients with HCM. (*Level of Evidence: C*)
2. Amiodarone may be considered for primary prophylaxis against SCD in patients with HCM who have 1 or more major risk factor for SCD (see Table 7 in the original full-text guideline document) if ICD implantation is not feasible. (*Level of Evidence: C*)

## **Arrhythmogenic Right Ventricular Cardiomyopathy (ARVC)**

### *Class I*

ICD implantation is recommended for the prevention of SCD in patients with ARVC with documented sustained VT or VF who are receiving chronic optimal medical therapy and who have reasonable expectation of survival with a good functional status for more than 1 year. (*Level of Evidence: B*)

### *Class IIa*

1. ICD implantation can be effective for the prevention of SCD in patients with ARVC with extensive disease, including those with LV involvement, 1 or more affected family member with SCD, or undiagnosed syncope when VT or VF



- has not been excluded as the cause of syncope, who are receiving chronic optimal medical therapy, and who have reasonable expectation of survival with a good functional status for more than 1 year. (*Level of Evidence: C*)
2. Amiodarone or sotalol can be effective for treatment of sustained VT or VF in patients with ARVC when ICD implantation is not feasible. (*Level of Evidence: C*)
  3. Ablation can be useful as adjunctive therapy in management of patients with ARVC with recurrent VT, despite optimal antiarrhythmic drug therapy. (*Level of Evidence: C*)

#### *Class IIb*

EP testing might be useful for risk assessment of SCD in patients with ARVC. (*Level of Evidence: C*)

### **Neuromuscular Disorders**

#### *Class I*

Patients with neuromuscular disorders who have ventricular arrhythmias should generally be treated in the same manner as patients without neuromuscular disorders. (*Level of Evidence: A*)

#### *Class IIb*

Permanent pacemaker insertion may be considered for neuromuscular diseases such as myotonic muscular dystrophy, Kearns-Sayre syndrome, Erb dystrophy, and peroneal muscular atrophy with any degree of AV block (including first-degree AV block) with or without symptoms, because there may be unpredictable progression of AV conduction disease. (*Level of Evidence: B*)

### **Heart Failure**

#### *Class I*

1. ICD therapy is recommended for secondary prevention of SCD in patients who survived VF or hemodynamically unstable VT, or VT with syncope and who have an LVEF less than or equal to 40%, who are receiving chronic optimal medical therapy, and who have a reasonable expectation of survival with a good functional status for more than 1 year. (*Level of Evidence: A*)
2. ICD therapy is recommended for primary prevention to reduce total mortality by a reduction in SCD in patients with LV dysfunction due to prior MI who are at least 40 day post-MI, have an LVEF less than or equal to 30% to 40%, are NYHA functional class II or III receiving chronic optimal medical therapy, and who have reasonable expectation of survival with a good functional status for more than 1 year. (*Level of Evidence: A*) (See section 1.2 in the original full-text guideline document)
3. ICD therapy is recommended for primary prevention to reduce total mortality by a reduction in SCD in patients with nonischemic heart disease who have an LVEF less than or equal to 30% to 35%, are NYHA functional class II or III, are receiving chronic optimal medical therapy, and who have reasonable

- expectation of survival with a good functional status for more than 1 year. (*Level of Evidence: B*) (See Section 1.2 in the original full-text guideline document.)
4. Amiodarone, sotalol, and/or other beta blockers are recommended pharmacological adjuncts to ICD therapy to suppress symptomatic ventricular tachyarrhythmias (both sustained and nonsustained) in otherwise optimally treated patients with HF. (*Level of Evidence: C*)
  5. Amiodarone is indicated for the suppression of acute hemodynamically compromising ventricular or supraventricular tachyarrhythmias when cardioversion and/or correction of reversible causes have failed to terminate the arrhythmia or prevent its early recurrence. (*Level of Evidence: B*)

#### *Class IIa*

1. ICD therapy combined with biventricular pacing can be effective for primary prevention to reduce total mortality by a reduction in SCD in patients with NYHA functional class III or IV, are receiving optimal medical therapy, in sinus rhythm with a QRS complex of at least 120 ms, and who have reasonable expectation of survival with a good functional status for more than 1 y. (*Level of Evidence: B*)
2. ICD therapy is reasonable for primary prevention to reduce total mortality by a reduction in SCD in patients with LV dysfunction due to prior MI who are at least 40 day post-MI, have an LVEF of less than or equal to 30% to 35%, are NYHA functional class I, are receiving chronic optimal medical therapy, and have reasonable expectation of survival with a good functional status for more than 1 y. (*Level of Evidence: B*) (See Section 1.2 in the original full-text guideline document.)
3. ICD therapy is reasonable in patients who have recurrent stable VT, a normal or near normal LVEF, and optimally treated HF and who have a reasonable expectation of survival with a good functional status for more than 1 year. (*Level of Evidence: C*)
4. Biventricular pacing in the absence of ICD therapy is reasonable for the prevention of SCD in patients with NYHA functional class III or IV HF, an LVEF less than or equal to 35%, and a QRS complex equal to or wider than 160 ms (or at least 120 ms in the presence of other evidence of ventricular dyssynchrony) who are receiving chronic optimal medical therapy and who have reasonable expectation of survival with a good functional status for more than 1 year. (*Level of Evidence: B*)

#### *Class IIb*

1. Amiodarone, sotalol, and/or beta blockers may be considered as pharmacological alternatives to ICD therapy to suppress symptomatic ventricular tachyarrhythmias (both sustained and nonsustained) in optimally treated patients with HF for whom ICD therapy is not feasible. (*Level of Evidence: C*)
2. ICD therapy may be considered for primary prevention to reduce total mortality by a reduction in SCD in patients with nonischemic heart disease who have an LVEF of less than or equal to 30% to 35%, are NYHA functional class I receiving chronic optimal medical therapy, and who have a reasonable expectation of survival with a good functional status for more than 1 year.

(*Level of Evidence: B*) (See Section 1.2 in the original full-text guideline document.)

## **Genetic Arrhythmia Syndromes**

### **Long QT Syndrome**

#### *Class I*

1. Lifestyle modification is recommended for patients with an LQTS diagnosis (clinical and/or molecular). (*Level of Evidence: B*)
2. Beta blockers are recommended for patients with an LQTS clinical diagnosis (i.e., in the presence of prolonged QT interval). (*Level of Evidence: B*)
3. Implantation of an ICD along with use of beta blockers is recommended for LQTS patients with previous cardiac arrest and who have reasonable expectation of survival with a good functional status for more than 1 year. (*Level of Evidence: A*)

#### *Class IIa*

1. Beta blockers can be effective to reduce SCD in patients with a molecular LQTS analysis and normal QT interval. (*Level of Evidence: B*)
2. Implantation of an ICD with continued use of beta blockers can be effective to reduce SCD in LQTS patients experiencing syncope and/or VT while receiving beta blockers and who have reasonable expectation of survival with a good functional status for more than 1 year. (*Level of Evidence: B*)

#### *Class IIb*

1. Left cardiac sympathetic neural denervation may be considered for LQTS patients with syncope, torsades de pointes, or cardiac arrest while receiving beta blockers. (*Level of Evidence: B*)
2. Implantation of an ICD with the use of beta blockers may be considered for prophylaxis of SCD for patients in categories possibly associated with higher risk of cardiac arrest such as LQT2 and LQT3 and who have reasonable expectation of survival with a good functional status for more than 1 year. (*Level of Evidence: B*)

### **Brugada Syndrome**

#### *Class I*

An ICD is indicated for Brugada syndrome patients with previous cardiac arrest receiving chronic optimal medical therapy and who have reasonable expectation of survival with a good functional status for more than 1 year (*Level of Evidence: C*)

#### *Class IIa*

1. An ICD is reasonable for Brugada syndrome patients with spontaneous ST-segment elevation in V<sub>1</sub>, V<sub>2</sub>, or V<sub>3</sub> who have had syncope with or without mutations demonstrated in the SCN5A gene and who have reasonable

- expectation of survival with a good functional status for more than 1 year. (*Level of Evidence: C*)
2. Clinical monitoring for the development of a spontaneous ST-segment elevation pattern is reasonable for the management of patients with ST-segment elevation induced only with provocative pharmacological challenge with or without symptoms. (*Level of Evidence: C*)
  3. An ICD is reasonable for Brugada syndrome patients with documented VT that has not resulted in cardiac arrest and who have reasonable expectation of survival with a good functional status for more than 1 year. (*Level of Evidence: C*)
  4. Isoproterenol can be useful to treat an electrical storm in the Brugada syndrome. (*Level of Evidence: C*)

#### *Class IIb*

1. EP testing may be considered for risk stratification in asymptomatic Brugada syndrome patients with spontaneous ST elevation with or without a mutation in the SCN5A gene. (*Level of Evidence: C*)
2. Quinidine might be reasonable for the treatment of electrical storm in patients with Brugada syndrome. (*Level of Evidence: C*)

### **Catecholaminergic Polymorphic Ventricular Tachycardia (CPVT)**

#### *Class I*

1. Beta blockers are indicated for patients who are clinically diagnosed with CPVT on the basis of the presence of spontaneous or documented stress-induced ventricular arrhythmias. (*Level of Evidence: C*)
2. Implantation of an ICD with use of beta blockers is indicated for patients with CPVT who are survivors of cardiac arrest and who have reasonable expectation of survival with a good functional status for more than 1 year. (*Level of Evidence: C*)

#### *Class IIa*

1. Beta blockers can be effective in patients without clinical manifestations when the diagnosis of CPVT is established during childhood based on genetic analysis. (*Level of Evidence: C*)
2. Implantation of an ICD with the use of beta blockers can be effective for affected patients with CPVT with syncope and/or documented sustained VT while receiving beta blockers and who have reasonable expectation of survival with a good functional status for more than 1 year. (*Level of Evidence: C*)

#### *Class IIb*

Beta blockers may be considered for patients with CPVT who were genetically diagnosed in adulthood and never manifested clinical symptoms of tachyarrhythmias. (*Level of Evidence: C*)

### **Arrhythmias in Structurally Normal Hearts**

## **Idiopathic Ventricular Tachycardia**

### *Class I*

Catheter ablation is useful in patients with structurally normal hearts with symptomatic, drug-refractory VT arising from the RV or LV or in those who are drug intolerant or who do not desire long-term drug therapy. (*Level of Evidence: C*)

### *Class IIa*

1. EP testing is reasonable for diagnostic evaluation in patients with structurally normal hearts with palpitations or suspected outflow tract VT. (*Level of Evidence: B*)
2. Drug therapy with beta blockers and/or calcium channel blockers (and/or IC agents in RV outflow tract [RVOT] VT) can be useful in patients with structurally normal hearts with symptomatic VT arising from the RV. (*Level of Evidence: C*)
3. ICD implantation can be effective therapy for the termination of sustained VT in patients with normal or near normal ventricular function and no structural heart disease who are receiving chronic optimal medical therapy and who have reasonable expectation of survival for more than 1 year. (*Level of Evidence: C*)

## **Electrolyte Disturbances**

### *Class I*

Potassium (and magnesium) salts are useful in treating ventricular arrhythmias secondary to hypokalemia (or hypomagnesemia) resulting from diuretic use in patients with structurally normal hearts. (*Level of Evidence: B*)

### *Class IIa*

1. It is reasonable to maintain serum potassium levels above 4.0 mM/L in any patient with documented life-threatening ventricular arrhythmias and a structurally normal heart. (*Level of Evidence: C*)
2. It is reasonable to maintain serum potassium levels above 4.0 mM/L in patients with acute MI. (*Level of Evidence: B*)
3. Magnesium salts can be beneficial in the management of VT secondary to digoxin toxicity in patients with structurally normal hearts. (*Level of Evidence: B*)

## **Alcohol**

### *Class I*

1. Complete abstinence from alcohol is recommended in cases where there is a suspected correlation between alcohol intake and ventricular arrhythmias. (*Level of Evidence: C*)

2. Persistent life-threatening ventricular arrhythmias despite abstinence from alcohol should be treated in the same manner that such arrhythmias are treated in patients with other diseases, including an ICD, as required, in patients receiving chronic optimal medical therapy and who have reasonable expectation of survival for more than 1 year. (*Level of Evidence: C*)

## **Smoking**

### *Class I*

Smoking should be strongly discouraged in all patients with suspected or documented ventricular arrhythmias and/or aborted SCD. (*Level of Evidence: B*)

## **Lipids**

### *Class I*

Statin therapy is beneficial in patients with CHD to reduce the risk of vascular events, possibly ventricular arrhythmias, and SCD. (*Level of Evidence: A*)

### *Class IIb*

n-3 polyunsaturated fatty acid supplementation may be considered for patients with ventricular arrhythmias and underlying CHD. (*Level of Evidence: B*)

## **Ventricular Arrhythmia and Sudden Cardiac Death Related to Specific Populations**

### **Athletes**

#### *Class I*

1. Preparticipation history and physical examination, including family history of premature or SCD and specific evidence of cardiovascular diseases such as cardiomyopathies and ion channel abnormalities, is recommended in athletes. (*Level of Evidence: C*)
2. Athletes presenting with rhythm disorders, structural heart disease, or other signs or symptoms suspicious for cardiovascular disorders should be evaluated as any other patient but with recognition of the potential uniqueness of their activity. (*Level of Evidence: C*)
3. Athletes presenting with syncope should be carefully evaluated to uncover underlying cardiovascular disease or rhythm disorder. (*Level of Evidence: B*)
4. Athletes with serious symptoms should cease competition while cardiovascular abnormalities are being fully evaluated. (*Level of Evidence: C*)

#### *Class IIb*

Twelve-lead ECG and possibly echocardiography may be considered as preparticipation screening for heart disorders in athletes. (*Level of Evidence: B*)

## **Gender and Pregnancy**

### *Class I*

1. Pregnant women developing hemodynamically unstable VT or VF should be electrically cardioverted or defibrillated. (*Level of Evidence: B*) (See Section above titled "Acute Management of Specific Arrhythmias".)
2. In pregnant women with the LQTS who have had symptoms, it is beneficial to continue beta-blocker medications throughout pregnancy and afterward, unless there are definite contraindications. (*Level of Evidence: C*)

## **Elderly Patients**

### *Class I*

1. Elderly patients with ventricular arrhythmias should generally be treated in the same manner as younger individuals. (*Level of Evidence: A*)
2. The dosing and titration schedule of antiarrhythmic drugs prescribed to elderly patients should be adjusted to the altered pharmacokinetics of such patients. (*Level of Evidence: C*)

### *Class III*

Elderly patients with projected life expectancy less than 1 year due to major comorbidities should not receive ICD therapy. (*Level of Evidence: C*)

## **Pediatric Patients**

### *Class I*

1. An ICD should be implanted in pediatric survivors of a cardiac arrest when a thorough search for a correctable cause is negative and the patients are receiving optimal medical therapy and have reasonable expectation of survival with a good functional status for more than 1 year. (*Level of Evidence: C*)
2. Hemodynamic and EP evaluation should be performed in the young patient with symptomatic, sustained VT. (*Level of Evidence: C*)
3. ICD therapy in conjunction with pharmacological therapy is indicated for high-risk pediatric patients with a genetic basis (ion channel defects or cardiomyopathy) for either SCD or sustained ventricular arrhythmias. The decision to implant an ICD in a child must consider the risk of SCD associated with the disease, the potential equivalent benefit of medical therapy, as well as risk of device malfunction, infection, or lead failure and that there is reasonable expectation of survival with a good functional status for more than 1 year. (*Level of Evidence: C*)

### *Class IIa*

1. ICD therapy is reasonable for pediatric patients with spontaneous sustained ventricular arrhythmias associated with impaired (LVEF of 35% or less) ventricular function who are receiving chronic optimal medical therapy and who have reasonable expectation of survival with a good functional status for more than 1 year. (*Level of Evidence: B*)

2. Ablation can be useful in pediatric patients with symptomatic outflow tract or septal VT that is drug resistant, when the patient is drug intolerant or wishes not to take drugs. (*Level of Evidence: C*)

### *Class III*

1. Pharmacological treatment of isolated PVCs in pediatric patients is not recommended. (*Level of Evidence: C*)
2. Digoxin or verapamil should not be used for treatment of sustained tachycardia in infants when VT has not been excluded as a potential diagnosis. (*Level of Evidence: C*)
3. Ablation is not indicated in young patients with asymptomatic NSVT and normal ventricular function. (*Level of Evidence: C*)

## **Patients With Implantable Cardioverter-Defibrillators**

### *Class I*

1. Patients with implanted ICDs should receive regular follow-up and analysis of the device status. (*Level of Evidence: C*)
2. Implanted ICDs should be programmed to obtain optimal sensitivity and specificity. (*Level of Evidence: C*)
3. Measures should be undertaken to minimize the risk of inappropriate ICD therapies. (*Level of Evidence: C*)
4. Patients with implanted ICDs who present with incessant VT should be hospitalized for management. (*Level of Evidence: C*)

### *Class IIa*

1. Catheter ablation can be useful for patients with implanted ICDs who experience incessant or frequently recurring VT. (*Level of Evidence: B*)
2. In patients experiencing inappropriate ICD therapy, EP evaluation can be useful for diagnostic and therapeutic purposes. (*Level of Evidence: C*)

## **Digitalis Toxicity**

### *Class I*

An antidigitalis antibody is recommended for patients who present with sustained ventricular arrhythmias, advanced AV block, and/or asystole that are considered due to digitalis toxicity. (*Level of Evidence: A*)

### *Class IIa*

1. Patients taking digitalis who present with mild cardiac toxicity (e.g., isolated ectopic beats only) can be managed effectively with recognition, continuous monitoring of cardiac rhythm, withdrawal of digitalis, restoration of normal electrolyte levels (including serum potassium greater than 4 mM/L), and oxygenation. (*Level of Evidence: C*)



2. Magnesium or pacing is reasonable for patients who take digitalis and present with severe toxicity (sustained ventricular arrhythmias, advanced AV block, and/or asystole). (*Level of Evidence: C*)

#### *Class IIb*

Dialysis for the management of hyperkalemia may be considered for patients who take digitalis and present with severe toxicity (sustained ventricular arrhythmias; advanced AV block, and/or asystole). (*Level of Evidence: C*)

#### *Class III*

Management by lidocaine or phenytoin is not recommended for patients taking digitalis and who present with severe toxicity (sustained ventricular arrhythmias, advanced AV block, and/or asystole). (*Level of Evidence: C*)

### **Drug-Induced Long QT Syndrome**

#### *Class I*

In patients with drug-induced LQTS, removal of the offending agent is indicated. (*Level of Evidence: A*)

#### *Class IIa*

1. Management with intravenous magnesium sulfate is reasonable for patients who take QT-prolonging drugs and present with few episodes of torsades de pointes in which the QT remains long. (*Level of Evidence: B*)
2. Atrial or ventricular pacing or isoproterenol is reasonable for patients taking QT-prolonging drugs who present with recurrent torsades de pointes. (*Level of Evidence: B*)

#### *Class IIb*

Potassium ion repletion to 4.5 to 5 mmol/L may be reasonable for patients who take QT-prolonging drugs and present with few episodes of torsades de pointes in whom the QT remains long. (*Level of Evidence: C*)

### **Sodium Channel Blocker–Related Toxicity**

#### *Class I*

In patients with sodium channel blocker–related toxicity, removal of the offending agent is indicated. (*Level of Evidence: A*)

#### *Class IIa*

1. Stopping the drug, reprogramming the pacemaker or repositioning leads can be useful in patients taking sodium channel blockers who present with

- elevated defibrillation thresholds or pacing requirement. (*Level of Evidence: C*)
2. In patients taking sodium channel blockers who present with atrial flutter with 1:1 AV conduction, withdrawal of the offending agent is reasonable. If the drug needs to be continued, additional A-V nodal blockade with diltiazem, verapamil, or beta blocker or atrial flutter ablation can be effective. (*Level of Evidence: C*)

#### *Class IIb*

Administration of a beta blocker and a sodium bolus may be considered for patients taking sodium channel blockers if the tachycardia becomes more frequent or more difficult to cardiovert. (*Level of Evidence: C*)

### **Other Drug-Induced Toxicity**

#### *Class I*

1. High intermittent doses and cumulative doses exceeding the recommended levels should be avoided in patients receiving anthracyclines such as doxorubicin. (*Level of Evidence: B*)
2. All patients receiving 5-fluorouracil therapy should receive close supervision and immediate discontinuation of the infusion if symptoms or signs of myocardial ischemia occur. Further treatment with 5-fluorouracil must be avoided in these individuals. (*Level of Evidence: C*)
3. Patients with known cardiac disease should have a full cardiac assessment including echocardiography, which should be undertaken prior to use of anthracyclines such as doxorubicin, and regular long-term follow-up should be considered. (*Level of Evidence: C*)

### **Definitions:**

#### **Levels of Evidence**

- **Level of Evidence A:** Data derived from multiple randomized clinical trials or meta-analyses.
- **Level of Evidence B:** Data derived from a single randomized trial, or nonrandomized studies.
- **Level of Evidence C:** Only consensus opinion of experts, case studies, or standard-of-care.

#### **Classification of Recommendations**

- **Class I:** Conditions for which there is evidence and/or general agreement that a given procedure/treatment is beneficial, useful, and effective.
- **Class II:** Conditions for which there is conflicting evidence and/or a divergence of opinion about the usefulness/efficacy of a procedure or treatment.
  - **Class IIa:** Weight of evidence/opinion is in favor of usefulness/efficacy.

- **Class IIb:** Usefulness/efficacy is less well established by evidence/opinion.
- **Class III:** Conditions for which there is evidence and/or general agreement that a procedure/treatment is not useful or effective and in some cases may be harmful.

## CLINICAL ALGORITHM(S)

One clinical algorithm is provided in the original guideline document: "Advanced Cardiac Life Support Pulseless Arrest Algorithm."

## EVIDENCE SUPPORTING THE RECOMMENDATIONS

### TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The recommendations are evidence based and derived primarily from published data. The weight of evidence is given for each recommendation (see the "Major Recommendations" field).

## BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

### POTENTIAL BENEFITS

Effective management of patients with ventricular arrhythmias and the prevention of sudden cardiac death

### POTENTIAL HARMS

- Exercise testing in patients with life-threatening ventricular arrhythmias may be associated with an incidence of arrhythmias requiring cardioversion, intravenous drugs, or resuscitation.
- Side effects of pharmacologic agents
  - The use of antiarrhythmic agents may predispose the patient to proarrhythmic complications that might pose significant threats to life.
  - Chronic administration of amiodarone is associated with complex drug interactions and a host of adverse side effects involving the lung, liver, thyroid, and skin. As a general rule, the longer the therapy and the higher dose of amiodarone, the greater is the likelihood that adverse side effects will require discontinuance of the drug. Sotalol, like amiodarone, is effective in suppressing ventricular arrhythmias, but it has greater proarrhythmic effects and has not been shown to provide a clear increase in survival
  - Intravenous procainamide can cause transient hypotension
- Problems associated with implantable cardioverter defibrillator (ICD) therapy include inappropriate shock discharge mostly for atrial fibrillation (AF) with rapid ventricular response, defibrillator storm with appropriate recurrent ICD discharge for recurrent ventricular tachyarrhythmias or inappropriate discharge for a multiplicity of reasons, infections related to device implantation, and exacerbation of HF when a high percentage of the heartbeats are paced from the right ventricle (RV) apex, especially when

ventricular function is already compromised. Device failure may also rarely occur.

## CONTRAINDICATIONS

### CONTRAINDICATIONS

- Sotalol should be avoided in patients with severely depressed left ventricular function or significant heart failure.
- Presentation with frequently recurring torsades de pointes in patients with congenital long QT syndrome (LQTS) is unusual. In this setting, catecholamines should be avoided.
- All patients with LQTS should avoid drugs known to prolong the QT interval and those that deplete potassium and magnesium.
- Contraindications to exercise testing can be found in Table 1 of the "American College of Cardiology (ACC)/American Heart Association (AHA) 2002 Guideline Update for Exercise Testing." (See "Availability of Companion Documents" field in this summary.)

## QUALIFYING STATEMENTS

### QUALIFYING STATEMENTS

- These practice guidelines are intended to assist health care providers in clinical decision making by describing a range of generally acceptable approaches for the diagnosis and management of specific diseases or conditions. These guidelines attempt to define practices that meet the needs of most patients in most circumstances. These guideline recommendations reflect a consensus of expert opinion after a thorough review of the available, current scientific evidence and are intended to improve patient care. If these guidelines are used as the basis for regulatory/payer decisions, the ultimate goal is quality of care and serving the patient's best interests. The ultimate judgment regarding care of a particular patient must be made by the health care provider and the patient in light of all of the circumstances presented by that patient. There are circumstances in which deviations from these guidelines are appropriate.
- It is important to note that experts can review the same data and arrive at different interpretations. Attempting to homogenize heterogeneous trials invariably leads to varying interpretations of the trial data. Furthermore, differences between the United States and Europe may modulate how recommendations are implemented. Guidelines are composed of recommendations on the basis of the best available medical science; however, implementation of these recommendations will be affected by the financial, cultural, and societal differences between individual countries.

## IMPLEMENTATION OF THE GUIDELINE

### DESCRIPTION OF IMPLEMENTATION STRATEGY

An implementation strategy was not provided.

## IMPLEMENTATION TOOLS

Clinical Algorithm  
Personal Digital Assistant (PDA) Downloads  
Pocket Guide/Reference Cards  
Quick Reference Guides/Physician Guides

For information about [availability](#), see the "Availability of Companion Documents" and "Patient Resources" fields below.

## INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

### IOM CARE NEED

Living with Illness

### IOM DOMAIN

Effectiveness

## IDENTIFYING INFORMATION AND AVAILABILITY

### BIBLIOGRAPHIC SOURCE(S)

European Heart Rhythm Association, Heart Rhythm Society, Zipes DP, Camm AJ, Borggrefe M, Buxton AE, Chaitman B, Fromer M, Gregoratos G, Klein G, Moss AJ, Myerburg RJ, Priori SG, Quinones MA, Roden DM, Silka MJ, Tracy C, Smith SC Jr, Jacobs AK, Adams CD, Antman EM, Anderson JL, Hunt SA, Halperin JL, Nishimura R, Ornato JP, Page RL, Riegel B, Priori SG, Blanc JJ, Budaj A, Camm AJ, Dean V, Deckers JW, Despres C, Dickstein K, Lekakis J, McGregor K, Metra M, Morais J, Osterspey A, Tamargo JL, Zamorano JL, American College of Cardiology, American Heart Association Task Force, European Society of Cardiology Committee for Practice Guidelines. ACC/AHA/ESC 2006 guidelines for management of patients with ventricular arrhythmias and the prevention of sudden cardiac death: a report of the American College of Cardiology/American Heart Association Task Force and the European Society [trunc]. J Am Coll Cardiol 2006 Sep 5;48(5):e247-346. [1085 references] [PubMed](#)

### ADAPTATION

Not applicable: The guideline was not adapted from another source.

### DATE RELEASED

2006 Sep 5

### GUIDELINE DEVELOPER(S)

American College of Cardiology Foundation - Medical Specialty Society  
American Heart Association - Professional Association  
European Heart Rhythm Association - Professional Association  
European Society of Cardiology - Medical Specialty Society  
Heart Rhythm Society - Professional Association

## **SOURCE(S) OF FUNDING**

American College of Cardiology Foundation  
American Heart Association  
European Society of Cardiology

## **GUIDELINE COMMITTEE**

American College of Cardiology/American Heart Association Task Force

European Society of Cardiology Committee for Practice Guidelines

Writing Committee to Develop Guidelines for Management of Patients With  
Ventricular Arrhythmias and the Prevention of Sudden Cardiac Death

## **COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE**

*Writing Committee Members:* Douglas P. Zipes, MD, MACC, FAHA, FESC, *Co-Chair*; A. John Camm, MD, FACC, FAHA, FESC, *Co-Chair*; Martin Borggrefe, MD, FESC; Alfred E. Buxton, MD, FACC, FAHA; Bernard Chaitman, MD, FACC, FAHA; Martin Fromer, MD; Gabriel Gregoratos, MD, FACC, FAHA; George Klein, MD, FACC; Arthur J. Moss, MD, FACC, FAHA<sup>†</sup>; Robert J. Myerburg, MD, FACC, FAHA; Silvia G. Priori, MD, PHD, FESC<sup>\*</sup>; Miguel A. Quinones, MD, FACC; Dan M. Roden, MD, CM, FACC, FAHA; Michael J. Silka, MD, FACC, FAHA; Cynthia Tracy, MD, FACC, FAHA

<sup>\*</sup>European Heart Rhythm Association Official Representative

<sup>†</sup>Heart Rhythm Society Official Representative

*ACC/AHA Task Force Members:* Sidney C. Smith, JR, MD, FACC, FAHA, FESC, *Chair*; Alice K. Jacobs, MD, FACC, FAHA, *Vice-Chair*; Cynthia D. Adams, MSN, APRN-BC, FAHA; Elliott M. Antman, MD, FACC, FAHA<sup>‡</sup>; Jeffrey L. Anderson, MD, FACC, FAHA; Sharon A. Hunt, MD, FACC, FAHA; Jonathan L. Halperin, MD, FACC, FAHA; Rick Nishimura, MD, FACC, FAHA; Joseph P. Ornato, MD, FACC, FAHA; Richard L. Page, MD, FACC, FAHA; Barbara Riegel, DNSC, RN, FAHA

<sup>‡</sup>Immediate Past Chair

*ESC Committee for Practice Guidelines:* Silvia G. Priori, MD, PHD, FESC, *Chair*; Jean-Jacques Blanc, MD, FESC, France; Andrzej Budaj, MD, FESC, Poland; A. John Camm, MD, FESC, FACC, FAHA, United Kingdom; Veronica Dean, France; Jaap W. Deckers, MD, FESC, The Netherlands; Catherine Despres, France; Kenneth Dickstein, MD, PHD, FESC, Norway; John Lekakis, MD, FESC, Greece; Keith McGregor, PHD, France; Marco Metra, MD, Italy; Joao Morais, MD, FESC, Portugal;

Ady Osterspey, MD, Germany; Juan Luis Tamargo, MD, FESC, Spain; José Luis Zamorano, MD, FESC, Spain

## **FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST**

The American College of Cardiology (ACC)/American Heart Association (AHA) Task Force on Practice Guidelines and the ESC Committee for Practice Guidelines make every effort to avoid any actual, potential, or perceived conflict of interest that might arise as a result of an industry relationship or personal interest of the writing committee. Specifically, all members of the Writing Committee, as well as peer reviewers of the document, were asked to provide disclosure statements of all such relationships that might be perceived as real or potential conflicts of interest. Writing Committee members are also strongly encouraged to declare a previous relationship with industry that might be perceived as relevant to guideline development. If a Writing Committee member develops a new relationship with industry during his or her tenure, he or she is required to notify guideline staff in writing. The continued participation of the Writing Committee member will be reviewed. These statements are reviewed by the parent Task Force, reported orally to all members of the Writing Committee as changes occur.

Please see Appendix 1 of the original full-length guideline document for author relationships with industry and Appendix 2 for peer reviewer relationships with industry that are pertinent to these guidelines.

## **GUIDELINE STATUS**

This is the current release of the guideline.

## **GUIDELINE AVAILABILITY**

Electronic copies: Available in Portable Document Format (PDF) from the [American College of Cardiology \(ACC\) Web site](#).

Copies are also available from the [American Heart Association \(AHA\) Web site](#), and the [European Society of Cardiology \(ESC\) Web site](#).

Print copies: Available from the American College of Cardiology, Resource Center, 9111 Old Georgetown Road, Bethesda, Maryland 20814-1699; (800) 253-4636 (US only).

## **AVAILABILITY OF COMPANION DOCUMENTS**

The following is available:

- ACC/AHA/ESC 2006 guidelines for management of patients with ventricular arrhythmias and the prevention of sudden cardiac death - executive summary. A report of the American College of Cardiology/American Heart Association Task Force and the European Society of Cardiology Committee for Practice Guidelines (Writing Committee to Develop Guidelines for Management of Patients With Ventricular Arrhythmias and the Prevention of Sudden Cardiac Death). *J Am Coll Cardiol* 2006 Sep;48(5):1064-1108.

Electronic copies: Available from the [American College of Cardiology \(ACC\) Web site](#).

- Consensus reached on new guidelines for management of patients with ventricular arrhythmias and the prevention of sudden cardiac death. Press release. 2006 Aug 21. 3 p. Available from the [American College of Cardiology \(ACC\) Web site](#).

Print copies: Available from the American College of Cardiology, Resource Center, 9111 Old Georgetown Road, Bethesda, Maryland 20814-1699; (800) 253-4636 (US only).

The following are also available:

- ACC/AHA/ESC 2006 guidelines for management of patients with ventricular arrhythmias and the prevention of sudden cardiac death – wallet card. 2006 Sep. 2 p. Electronic copies: Available from the [American Heart Association \(AHA\) Web site](#).
- Management of patients with ventricular arrhythmias and the prevention of sudden cardiac death. Pocket guideline. Electronic copies: Available from the [European Society of Cardiology \(ESC\) Web site](#). Also available for PDA download from the [ESC Web site](#).
- ACC/AHA/ESC pocket guideline. Based on the ACC/AHA/ESC 2006 guidelines. Management of patients with ventricular arrhythmias and the prevention of sudden cardiac death. 2006 Sep. 54 p. Electronic copies: Available from the [American Heart Association \(AHA\) Web site](#).

## **PATIENT RESOURCES**

None available

## **NGC STATUS**

This NGC summary was completed by ECRI on November 22, 2006. The information was verified by the guideline developer on June 4, 2007. This summary was updated by ECRI Institute on July 12, 2007 following the U.S. Food and Drug Administration (FDA) advisory on Troponin-1 Immunoassay.

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