

Table 2. Inconsistencies Between ACC/AHA/ESC Guidelines for the Management of Patients With Ventricular Arrhythmias and the Prevention of SCD and Other Published ACC/AHA and ESC Guidelines With Respect to ICD Therapy for Primary Prevention to Reduce Total Mortality by a Reduction in SCD

Group addressed in recommendation	Guideline and Class of Recommendation with Level of Evidence* for Each Group				
	2005 ACC/AHA HF	2005 ESC HF	2004 ACC/AHA STEMI	2002 ACC/AHA/NASPE PM and ICD	Comment from the ACC/AHA/ESC VA & SCD Guidelines
LVD d/t MI, LVEF ≤30%, NYHA II, III	<i>Class I; LOE: B</i>	<i>Class I; LOE: A</i>	<i>Class IIa; LOE: B</i>	<i>Class IIa; LOE: B</i>	VA & SCD has combined all trials that enrolled patients with LVD d/t MI into one recommendation, <i>Class I; LOE: A</i>
LVD d/t MI, LVEF 30% to 35%, NYHA II, III	<i>Class IIa; LOE: B</i>	<i>Class I; LOE: A</i>	N/A	N/A	
LVD d/t MI, LVEF 30% to 40%, NSVT, positive EP study	N/A	N/A	<i>Class I; LOE: B</i>	<i>Class IIb; LOE: B</i>	
LVD d/t MI, LVEF ≤30%, NYHA I	<i>Class IIa; LOE: B</i>	N/A	N/A	N/A	VA & SCD has expanded the range of LVEF to ≤30% to 35% for patients with LVD d/t MI and NYHA functional class I into one recommendation, <i>Class IIa; LOE: B</i> .
LVD d/t MI, LVEF ≤31% to 35%, NYHA I	N/A	N/A	N/A	N/A	
NICM, LVEF ≤30%, NYHA II, III	<i>Class I; LOE: B</i>	<i>Class I; LOE: A</i>	N/A	N/A	VA & SCD has combined all trials of NICM, NYHA II, III into one recommendation, <i>Class I; LOE: B</i>
NICM, LVEF 30% to 35%, NYHA II, III	<i>Class IIa; LOE: B</i>	<i>Class I; LOE: A</i>	N/A	N/A	
NICM, LVEF ≤30%, NYHA I	<i>Class IIb; LOE: C</i>	N/A	N/A	N/A	VA & SCD has expanded the range of LVEF to ≤30% to 35% for patients with NICM and NYHA functional class I into one recommendation, <i>Class IIb; LOE: B</i> .
NICM, LVEF ≤31% to 35%, NYHA I	N/A	N/A	N/A	N/A	

*For an explanation of class of recommendation and level of evidence, see Table 1.

ACC/AHA HF = ACC/AHA 2005 Guideline Update for the Diagnosis and Management of Chronic Heart Failure in the Adult; ACC/AHA/NASPE PM and ICD = ACC/AHA/NASPE 2002 Guidelines Update for Implantation of Cardiac Pacemakers and Antiarrhythmia Devices; ACC/AHA STEMI = ACC/AHA 2004 Guidelines for the Management of

Patients with ST-Elevation Myocardial Infarction; EP = electrophysiological; ESC HF = ESC 2005 Guidelines for the Diagnosis and Treatment of Chronic Heart Failure; LOE = level of evidence; LVD d/t MI = left ventricular dysfunction due to prior myocardial infarction; LVEF = left ventricular ejection fraction; N/A = populations not addressed; NICM = nonischemic cardiomyopathy; NSVT = nonsustained ventricular tachycardia; NYHA = New York Heart Association functional class; SCD = sudden cardiac death; VA = ventricular arrhythmias

Table 3. Classification of Ventricular Arrhythmias

Classification by Electrocardiography	
Nonsustained VT	Three or more beats in duration, terminating spontaneously in less than 30 seconds. VT is a cardiac arrhythmia of 3 or more consecutive complexes in duration emanating from the ventricles at a rate of greater than 100 bpm (cycle length less than 600 ms).
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 seconds in duration and/or requiring termination due to hemodynamic compromise in less than 30 seconds.
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 reentrant tachycardia	VT due to reentry involving the His-Purkinje 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	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: ■ "Typical" initiated following "short-long-short" coupling intervals ■ Short coupled variant initiated by normal-short coupling.
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.

This table has been extracted from Table 4 of the full-text guidelines.

LBBB = left bundle-branch block; VT = ventricular tachycardia.



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For a copy of the full report or published executive summary, visit our Web sites at <http://www.acc.org>, <http://www.americanheart.org>, or <http://www.esccardio.org> or call the ACC Resource Center at 1-800-253-4636, ext. 694.

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Table 4. 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
 - Asystolic (sinus arrest, atrioventricular block)
 - Ventricular tachycardia
 - Ventricular fibrillation
 - Pulseless electrical activity

Table 5. Risk Factors for SCD in Hypertrophic Cardiomyopathy

Major risk factors	Possible in individual patients
Cardiac arrest (VF)	AF
Spontaneous sustained VT	Myocardial ischemia
Family history of premature sudden death	LV outflow obstruction
Unexplained syncope	High-risk mutation
LV thickness greater than or equal to 30 mm	Intense (competitive) physical exertion
Abnormal exercise BP	
Nonsustained spontaneous VT	

Modified with permission from Maron BJ, McKenna WJ, Danielson GK, et al. American College of Cardiology/ European Society of Cardiology clinical expert consensus document on hypertrophic cardiomyopathy. A report of the American College of Cardiology Foundation Task Force on Clinical Expert Consensus Documents and the European Society of Cardiology Committee for Practice Guidelines. J Am Coll Cardiol 2003; 42:1687–713.

AF = atrial fibrillation; **BP** = blood pressure; **LV** = left ventricular; **SCD** = sudden cardiac death; **VF** = ventricular fibrillation; **VT** = ventricular tachycardia.

Table 6. Drug Interactions Causing Arrhythmias

Drugs	Interacting Drug	Effect
Increased Concentration of Arrhythmogenic Drug		
Digoxin	Some antibiotics	By eliminating gut flora that metabolize digoxin, some antibiotics may increase digoxin bioavailability. Note: some antibiotics also interfere with P-glycoprotein (expressed in the intestine and elsewhere), another effect that can elevate digoxin concentration
Digoxin	Amiodarone Quinidine Verapamil Cyclosporine Itraconazole Erythromycin	Increased digoxin bioavailability, reduced biliary and renal excretion due to P-glycoprotein inhibition Digoxin toxicity
Quinidine	Ketoconazole	Increased drug levels
Cisapride	Itraconazole	
Terfenadine, astemizole	Erythromycin* Clarithromycin Some calcium blockers* Some HIV protease inhibitors (especially ritanovir)	
Beta blockers, propafenone	Quinidine (even ultra-low dose) Fluoxetine	Increased beta blockade Increased beta blockade
Flecainide	Some tricyclic antidepressants	Increased adverse effects Decreased analgesia (due to failure of biotransformation to the active metabolite morphine)
Dofetilide	Verapamil Cimetidine Trimethoprim Ketoconazole Megestrol	Increased plasma dofetilide concentration due to inhibition of renal excretion

Drugs	Interacting Drug	Effect
Decreased Concentration of Arrhythmogenic Drug		
Digoxin	Antacids Rifampin	Decreased digoxin effect due to decreased absorption Increased P-glycoprotein activity
Quinidine, mexiletine	Rifampin, barbiturates	Induced drug metabolism
Synergistic Pharmacological Activity Causing Arrhythmias		
QT-prolonging antiarrhythmics	Diuretics	Increased torsades de pointes risk due to diuretic-induced hypokalemia
Beta blockers	Amiodarone, clonidine, digoxin, diltiazem, verapamil	Bradycardia when used in combination
Digoxin	Amiodarone, beta blockers, clonidine, diltiazem, verapamil	
Verapamil	Amiodarone, beta blockers, clonidine, digoxin, diltiazem	
Diltiazem	Amiodarone, beta blockers, clonidine, digoxin, verapamil	
Clonidine	Amiodarone, beta blockers, digoxin, diltiazem, verapamil	
Amiodarone	Beta blockers, clonidine, digoxin, diltiazem, verapamil	
Sildenafil	Nitrates	Increased and persistent vasodilation; risk of myocardial ischemia

* These may also accumulate to toxic levels with co-administration of inhibitor drugs like ketoconazole.

Data are from Roden DM, Anderson ME. Proarrhythmia. In Kass RS, Clancy CE, editors. Handbook of Pharmacology: vol. 171. Basis and Treatment of Cardiac Arrhythmias. Boston: Springer Verlag, 2006:288-304.

Table 7. Syndromes of Drug-Induced Arrhythmias and Their Management

Drugs	Clinical setting	Management*
Digitalis	Mild cardiac toxicity (isolated arrhythmias only)	
	Severe toxicity: Sustained ventricular arrhythmias; advanced AV block; asystole	Anti-digitalis antibody Pacing
		Dialysis for hyperkalemia
QT-prolonging drugs	Torsades de pointes: few episodes, QT remains long	IV magnesium sulfate (MgSO4) Replete potassium (K ⁺) to 4.5 to 5 mEq/L
	Recurrent torsades de pointes	Ventricular pacing Isoproterenol
Sodium-channel blockers	Elevated defibrillation or pacing requirement	Stop drug; reposition leads
	Atrial flutter with 1:1 AV conduction	Diltiazem, verapamil, beta blocker (IV)
	Ventricular tachycardia (more frequent; difficult to cardiovert)	Beta blocker; sodium
	Brugada syndrome	Stop drug; treat arrhythmia

*Always includes recognition, continuous monitoring of cardiac rhythm, withdrawal of offending agents, restoration of normal electrolytes (including serum potassium to greater than 4 mEq/L) and oxygenation. The order shown is not meant to represent the preferred sequence when more than one treatment is listed.

AV = atrioventricular; **IV** = intravenous.