Appropriate Use Criteria for ICD/CRT – Online Appendix
Guideline Mapping and References Document

Section 1: Secondary Prevention

Table 1.1 CAD: VF or Hemodynamically Unstable VT Associated With Acute (<48 hours) MI (Newly Diagnosed, No Prior Assessment of EF)

Total Revascularization Completed After Cardiac Arrest			
LVEF	**≥50%**	**36-49%**	**≤35%**
1. Single episode VF or polymorphic VT during acute (<48 hours) MI			
2008 DEVICE-BASED THERAPY GUIDELINES: CLASS III • ICD therapy is not indicated for patients with ventricular tachyarrhythmias due to a completely reversible disorder in the absence of structural heart disease (e.g., electrolyte imbalance, drugs, or trauma). (*Level of Evidence: B*) (2)			
2. Recurrent VF or polymorphic VT during acute (<48 hours) MI			
Not addressed in guidelines			
3. VF or polymorphic VT during acute (<48 hours) MI NSVT 4 days post MI Inducible VT/VF at EPS ≥4 days after revascularization			
2008 DEVICE-BASED THERAPY GUIDELINES: **3. Recommendations for Implantable Cardioverter Defibrillators** CLASS I • ICD therapy is indicated in patients with nonsustained VT due to prior MI, LVEF less than or equal to 40%, and inducible VF or sustained VT at electrophysiological study. (*Level of Evidence: B*) (2-4)			
No Revascularization Indicated (i.e., No Significant CAD)			
LVEF	**≥50%**	**36-49%**	**≤35%**
4. Single episode VF or polymorphic VT during acute (<48 hours) MI			
Not addressed in guidelines			
5. Recurrent VF or polymorphic VT during acute (<48 hours) MI			
Not addressed in guidelines			
Obstructive CAD With Coronary Not Amenable to Revascularization			
LVEF	**≥50%**	**36-49%**	**≤35%**
6. VF or polymorphic VT during acute (<48 hours) MI No EPS done			
Not addressed in guidelines			

References:

1. Epstein AE, DiMarco JP, Ellenbogen KA, Estes NAM III, Freedman RA, Gettes LS, Gillinov AM, Gregoratos G, Hammill SC, Hayes DL, Hlatky MA, Newby LK, Page RL, Schoenfeld MH, Silka MJ, Stevenson LW, Sweeney MO. ACC/AHA/HRS 2008 guidelines for device-based therapy of cardiac rhythm abnormalities: a report of the American College of Cardiology/American Heart Association Task Force on Practice

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Guidelines (Writing Committee to Revise the ACC/AHA/NASPE 2002 Guideline Update for Implantation of Cardiac Pacemakers and Antiarrhythmia Devices). J Am Coll Cardiol 2008;51:e1–62.
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Table 1.2 CAD: VF or Hemodynamically Unstable VT <48 Hours (Acute) Post-Elective Revascularization

LVEF	≥50%	36-49%	≤35%
7. No evidence for acute coronary occlusion, restenosis, preceding infarct, or other clearly reversible cause			
2008 DEVICE-BASED THERAPY GUIDELINES: **3. Recommendations for Implantable Cardioverter Defibrillators** CLASS I • ICD therapy is indicated in patients who are survivors of cardiac arrest due to VF or hemodynamically unstable sustained VT after evaluation to define the cause of the event and to exclude any completely reversible causes. (*Level of Evidence: A*) (2-8)			

References:
1. Epstein AE, DiMarco JP, Ellenbogen KA, Estes NAM III, Freedman RA, Gettes LS, Gillinov AM, Gregoratos G, Hammill SC, Hayes DL, Hlatky MA, Newby LK, Page RL, Schoenfeld MH, Silka MJ, Stevenson LW, Sweeney MO. ACC/AHA/HRS 2008 guidelines for device-based therapy of cardiac rhythm abnormalities: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to Revise the ACC/AHA/NASPE 2002 Guideline Update for Implantation of Cardiac Pacemakers and Antiarrhythmia Devices). J Am Coll Cardiol 2008;51:e1–62.
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4. Wever EF, Hauer RN, van Capelle FL, et al. Randomized study of implantable defibrillator as first-choice therapy versus conventional strategy in postinfarct sudden death survivors. Circulation. 1995;91: 2195–203.
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9.

Table 1.3 CAD: VF or Hemodynamically Unstable VT [No Recent MI (≤40 days) Prior to VF/VT and/or No Recent Revascularization (≤3 Months) Prior to VF/VT]

LVEF	≥50%	36-49%	≤35%
8. No identifiable transient and completely reversible causes No need for revascularization identified by cath performed following VF/VT			
2008 DEVICE-BASED THERAPY GUIDELINES:			

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3. Recommendations for Implantable Cardioverter Defibrillators

CLASS I

- ICD therapy is indicated in patients who are survivors of cardiac arrest due to VF or hemodynamically unstable sustained VT after evaluation to define the cause of the event and to exclude any completely reversible causes. (*Level of Evidence: A*) (3-9)

CLASS IIa

- ICD implantation is reasonable for patients with sustained VT and normal or near-normal ventricular function. (*Level of Evidence: C*)

2009 HEART FAILURE GUIDELINES:

4.3.1. Patients With Reduced Left Ventricular Ejection Fraction

CLASS I

- An implantable cardioverter-defibrillator is recommended as secondary prevention to prolong survival in patients with current or prior symptoms of HF and reduced LVEF who have a history of cardiac arrest, ventricular fibrillation, or Hemodynamically destabilizing ventricular tachycardia (10-12). (*Level of Evidence: A*)

2006 VENTRICULAR ARRHYTHMIA GUIDELINES:

10. Heart Failure

Class I

- 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 y. (*Level of Evidence: A*)

LVEF	≥50%	36-49%	≤35%
9. No revascularization performed (significant CAD present at cath performed following VF/VT, but coronary anatomy not amenable to revascularization)			

2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

CLASS I

- ICD therapy is indicated in patients who are survivors of cardiac arrest due to VF or hemodynamically unstable sustained VT after evaluation to define the cause of the event and to exclude any completely reversible causes. (*Level of Evidence: A*) (3-9)

2009 HEART FAILURE GUIDELINES:

4.3.1. Patients With Reduced Left Ventricular Ejection Fraction

CLASS I

- An implantable cardioverter-defibrillator is recommended as secondary prevention to prolong survival in patients with current or prior symptoms of HF and reduced LVEF who have a history of cardiac arrest, ventricular fibrillation, or Hemodynamically destabilizing ventricular tachycardia (10-12). (*Level of Evidence: A*)

2006 VENTRICULAR ARRHYTHMIA GUIDELINES:

8.1. Left Ventricular Dysfunction Due to Prior Myocardial Infarction

Class I

- 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 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 y. (*Level of Evidence: A*)

LVEF	≥50%	36-49%	≤35%

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10. Significant CAD identified at cath performed following VF/VT Complete revascularization performed after cardiac arrest			
Not addressed in guidelines			
LVEF	**≥50%**	**36-49%**	**≤35%**
11. Significant CAD identified at cath performed following VF/VT Incomplete revascularization performed after cardiac arrest			
Not addressed in guidelines			

References:

1. Epstein AE, DiMarco JP, Ellenbogen KA, Estes NAM III, Freedman RA, Gettes LS, Gillinov AM, Gregoratos G, Hammill SC, Hayes DL, Hlatky MA, Newby LK, Page RL, Schoenfeld MH, Silka MJ, Stevenson LW, Sweeney MO. ACC/AHA/HRS 2008 guidelines for device-based therapy of cardiac rhythm abnormalities: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to Revise the ACC/AHA/NASPE 2002 Guideline Update for Implantation of Cardiac Pacemakers and Antiarrhythmia Devices). J Am Coll Cardiol 2008;51:e1–62.
2. Hunt SA, Abraham WT, Chin MH, Feldman AM, Francis GS, Ganiats TG, Jessup M, Konstam MA, Mancini DM, Michl K, Oates JA, Rahko PS, Silver MA, Stevenson LW, Yancy CW. 2009 focused update incorporated into the ACC/AHA 2005 guidelines for the diagnosis and management of heart failure in adults: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. J Am Coll Cardiol 2009;53:e1–90.
3. 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. 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). J Am Coll Cardiol 2006;48:e247– e346.
4. The Antiarrhythmics versus Implantable Defibrillators (AVID) Investigators. A comparison of antiarrhythmic-drug therapy with implantable defibrillators in patients resuscitated from near-fatal ventricular arrhythmias. N Engl J Med. 1997;337:1576–83.
5. Wever EF, Hauer RN, van Capelle FL, et al. Randomized study of implantable defibrillator as first-choice therapy versus conventional strategy in postinfarct sudden death survivors. Circulation. 1995;91: 2195–203.
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11. Mark DB, Nelson CL, Anstrom KJ, et al. Cost-effectiveness of defibrillator therapy or amiodarone in chronic stable heart failure: results from the Sudden Cardiac Death in Heart Failure Trial (SCD-HeFT). Circulation. 2006;114:135– 42.
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Table 1.4 CAD: VF or Hemodynamically Unstable VT During Exercise Testing Associated With Significant CAD

LVEF	**≥50%**	**36-49%**	**≤35%**
12. No revascularization performed (significant CAD present at cath performed following VF/VT, but coronary anatomy not amenable to revascularization)			

2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

CLASS I

- ICD therapy is indicated in patients who are survivors of cardiac arrest due to VF or hemodynamically unstable sustained VT after evaluation to define the cause of the event and to exclude any completely reversible causes. (*Level of Evidence: A*) (3-9)

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2009 HEART FAILURE GUIDELINES:

4.3.1. Patients With Reduced Left Ventricular Ejection Fraction

CLASS I

- An implantable cardioverter-defibrillator is recommended as secondary prevention to prolong survival in patients with current or prior symptoms of HF and reduced LVEF who have a history of cardiac arrest, ventricular fibrillation, or Hemodynamically destabilizing ventricular tachycardia (10-12). (*Level of Evidence: A*)

2006 VENTRICULAR ARRHYTHMIA GUIDELINES:

8.1. Left Ventricular Dysfunction Due to Prior Myocardial Infarction

Class I

- 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 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 y. (*Level of Evidence: A*)

LVEF	≥50%	36-49%	≤35%
13. Significant CAD identified at cath performed following VF/VT Complete revascularization performed after cardiac arrest			
Not addressed in guidelines			

LVEF	≥50%	36-49%	≤35%
14. Significant CAD identified at cath performed following VF/VT Incomplete revascularization performed after cardiac arrest			
Not addressed in guidelines			

References:

1. Epstein AE, DiMarco JP, Ellenbogen KA, Estes NAM III, Freedman RA, Gettes LS, Gillinov AM, Gregoratos G, Hammill SC, Hayes DL, Hlatky MA, Newby LK, Page RL, Schoenfeld MH, Silka MJ, Stevenson LW, Sweeney MO. ACC/AHA/HRS 2008 guidelines for device-based therapy of cardiac rhythm abnormalities: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to Revise the ACC/AHA/NASPE 2002 Guideline Update for Implantation of Cardiac Pacemakers and Antiarrhythmia Devices). J Am Coll Cardiol 2008;51:e1–62.
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10. Bokhari F, Newman D, Greene M, et al. Long-term comparison of the implantable cardioverter defibrillator versus amiodarone: elevenyear follow-up of a subset of patients in the Canadian Implantable Defibrillator Study (CIDS). Circulation. 2004;110:112– 6.

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11. Mark DB, Nelson CL, Anstrom KJ, et al. Cost-effectiveness of defibrillator therapy or amiodarone in chronic stable heart failure: results from the Sudden Cardiac Death in Heart Failure Trial (SCD-HeFT). Circulation. 2006;114:135– 42.
12. Bardy GH, Lee KL, Mark DB, et al. Amiodarone or an implantable cardioverter-defibrillator for congestive heart failure. N Engl J Med. 2005;352:225–37.

Table 1.5 NO CAD: VF or Hemodynamically Unstable VT

LVEF	≥50%	36-49%	≤35%
15. Dilated nonischemic cardiomyopathy			
2006 VENTRICULAR ARRHYTHMIA GUIDELINES: **9.1. Dilated Cardiomyopathy (Nonischemic)** Class I • 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 y. (*Level of Evidence: A*)			
16. VT/VF associated with cocaine abuse			
2008 DEVICE-BASED THERAPY GUIDELINES: CLASS III • ICD therapy is not indicated for patients with ventricular tachyarrhythmias due to a completely reversible disorder in the absence of structural heart disease (e.g., electrolyte imbalance, drugs, or trauma). (*Level of Evidence: B*) (3)			
Severe Valvular Disease **VT/VF <48 Hours After Surgical Repair or Replacement of Aortic or Mitral Valve**			
LVEF	**≥50%**	**36-49%**	**≤35%**
17. No evidence for post-operative valvular dysfunction			
2008 DEVICE-BASED THERAPY GUIDELINES: **3. Recommendations for Implantable Cardioverter Defibrillators** CLASS I • ICD therapy is indicated in patients who are survivors of cardiac arrest due to VF or hemodynamically unstable sustained VT after evaluation to define the cause of the event and to exclude any completely reversible causes. (*Level of Evidence: A*) (3-9) **2009 HEART FAILURE GUIDELINES:** **4.3.1. Patients With Reduced Left Ventricular Ejection Fraction** CLASS I • An implantable cardioverter-defibrillator is recommended as secondary prevention to prolong survival in patients with current or prior symptoms of HF and reduced LVEF who have a history of cardiac arrest, ventricular fibrillation, or Hemodynamically destabilizing ventricular tachycardia (10-12). (*Level of Evidence: A*) **2006 VENTRICULAR ARRHYTHMIA GUIDELINES:** **9.1. Dilated Cardiomyopathy (Nonischemic)** Class I • 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 y. (*Level of Evidence: A*)			

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10. Heart Failure

Class I

- 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 y. (*Level of Evidence: A*)

VF/Hemodynamically Unstable VT Associated With Other Structural Heart Disease

18. Myocardial sarcoidosis

2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

CLASS I

- ICD therapy is indicated in patients who are survivors of cardiac arrest due to VF or hemodynamically unstable sustained VT after evaluation to define the cause of the event and to exclude any completely reversible causes. (*Level of Evidence: A*) (3-9)

CLASS IIa

- ICD implantation is reasonable for patients with cardiac sarcoidosis, giant cell myocarditis, or Chagas disease. (*Level of Evidence: C*)

2006 VENTRICULAR ARRHYTHMIA GUIDELINES:

8.4.2. 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 y. (*Level of Evidence: C*)

19. Myocarditis; not giant cell myocarditis

2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

CLASS I

- ICD therapy is indicated in patients who are survivors of cardiac arrest due to VF or hemodynamically unstable sustained VT after evaluation to define the cause of the event and to exclude any completely reversible causes. (*Level of Evidence: A*) (3-9)

2006 VENTRICULAR ARRHYTHMIA GUIDELINES:

8.4.1. Myocarditis, Rheumatic Disease, and Endocarditis

Class IIa

- ICD implantation can be beneficial in patients with life-threatening ventricular arrhythmias who are not in the acute phase of myocarditis, as indicated in the ACC/AHA/NASPE 2002 Guideline Update for Implantation of Cardiac Pacemakers and Antiarrhythmia Devices (13), who are receiving chronic optimal medical therapy, and who have reasonable expectation of survival with a good functional status for more than 1 y. (*Level of Evidence: C*)

Class III

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

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20. Giant cell myocarditis
<u>2008 DEVICE-BASED THERAPY GUIDELINES:</u> **3. Recommendations for Implantable Cardioverter Defibrillators** CLASS I • ICD therapy is indicated in patients who are survivors of cardiac arrest due to VF or hemodynamically unstable sustained VT after evaluation to define the cause of the event and to exclude any completely reversible causes. (*Level of Evidence: A*) (3-9) CLASS IIa • ICD implantation is reasonable for patients with cardiac sarcoidosis, giant cell myocarditis, or Chagas disease. (*Level of Evidence: C*)
21. Takatsubo cardiomyopathy (stress induced cardiomyopathy, apical ballooning syndrome) ≥48 hours of onset of symptoms
Not addressed in guidelines

References:

1. Epstein AE, DiMarco JP, Ellenbogen KA, Estes NAM III, Freedman RA, Gettes LS, Gillinov AM, Gregoratos G, Hammill SC, Hayes DL, Hlatky MA, Newby LK, Page RL, Schoenfeld MH, Silka MJ, Stevenson LW, Sweeney MO. ACC/AHA/HRS 2008 guidelines for device-based therapy of cardiac rhythm abnormalities: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to Revise the ACC/AHA/NASPE 2002 Guideline Update for Implantation of Cardiac Pacemakers and Antiarrhythmia Devices). J Am Coll Cardiol 2008;51:e1–62.
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Table 1.6 Genetic Diseases with Sustained VT/VF

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22. Congenital Long QT

2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

CLASS I

- ICD therapy is indicated in patients who are survivors of cardiac arrest due to VF or hemodynamically unstable sustained VT after evaluation to define the cause of the event and to exclude any completely reversible causes. (*Level of Evidence: A*) (2-8)

2006 VENTRICULAR ARRHYTHMIA GUIDELINES:

11.1.1. Long QT Syndrome

Class I

- 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 y. (*Level of Evidence: A*)

23. Short QT

2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

CLASS I

- ICD therapy is indicated in patients who are survivors of cardiac arrest due to VF or hemodynamically unstable sustained VT after evaluation to define the cause of the event and to exclude any completely reversible causes. (*Level of Evidence: A*) (2-8)

24. Catecholaminergic Polymorphic VT

2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

CLASS I

- ICD therapy is indicated in patients who are survivors of cardiac arrest due to VF or hemodynamically unstable sustained VT after evaluation to define the cause of the event and to exclude any completely reversible causes. (*Level of Evidence: A*) (2-8)

CLASS IIa

- ICD implantation is reasonable for patients with catecholaminergic polymorphic VT who have syncope and/or documented sustained VT while receiving beta blockers. (*Level of Evidence: C*)

2006 VENTRICULAR ARRHYTHMIA GUIDELINES:

11.1.4. Catecholaminergic Polymorphic Ventricular Tachycardia

Class I

- 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 y. (*Level of Evidence: C*)

Class IIa

- 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 y. (*Level of Evidence: C*)

25. Brugada syndrome

2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

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CLASS I

- ICD therapy is indicated in patients who are survivors of cardiac arrest due to VF or hemodynamically unstable sustained VT after evaluation to define the cause of the event and to exclude any completely reversible causes. (*Level of Evidence: A*) (2-8)

CLASS IIa

- ICD implantation is reasonable for patients with Brugada syndrome who have documented VT that has not resulted in cardiac arrest. (*Level of Evidence: C*)

2006 VENTRICULAR ARRHYTHMIA GUIDELINES:

11.1.3. 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 y. (*Level of Evidence: C*)

Class IIa

- 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 y. (*Level of Evidence: C*)

26. ARVC with successful ablation of all inducible monomorphic VTs

Not addressed in guidelines

27. ARVC with unsuccessful attempt to ablate an inducible VT

2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

CLASS I

- ICD therapy is indicated in patients who are survivors of cardiac arrest due to VF or hemodynamically unstable sustained VT after evaluation to define the cause of the event and to exclude any completely reversible causes. (*Level of Evidence: A*) (2-8)

28. ARVC without attempted ablation

2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

CLASS I

- ICD therapy is indicated in patients who are survivors of cardiac arrest due to VF or hemodynamically unstable sustained VT after evaluation to define the cause of the event and to exclude any completely reversible causes. (*Level of Evidence: A*) (2-8)

29. Hypertrophic cardiomyopathy

2011 Hypertrophic Cardiomyopathy Guidelines

Class I

ICD placement is recommended for patients with HCM with prior documented cardiac arrest, ventricular fibrillation, or hemodynamically significant VT (9-12). (*Level of Evidence: B*)

References:

1. Epstein AE, DiMarco JP, Ellenbogen KA, Estes NAM III, Freedman RA, Gettes LS, Gillinov AM, Gregoratos G, Hammill SC, Hayes DL, Hlatky MA, Newby LK, Page RL, Schoenfeld MH, Silka MJ, Stevenson LW, Sweeney MO. ACC/AHA/HRS 2008 guidelines for device-based therapy of cardiac rhythm abnormalities: a report of the American College of Cardiology/American Heart Association Task Force on Practice

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Guidelines (Writing Committee to Revise the ACC/AHA/NASPE 2002 Guideline Update for Implantation of Cardiac Pacemakers and Antiarrhythmia Devices). J Am Coll Cardiol 2008;51:e1–62.
2. 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. 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). J Am Coll Cardiol 2006;48:e247– e346.
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4. Wever EF, Hauer RN, van Capelle FL, et al. Randomized study of implantable defibrillator as first-choice therapy versus conventional strategy in postinfarct sudden death survivors. Circulation. 1995;91: 2195–203.
5. Siebels J, Kuck KH. Implantable cardioverter defibrillator compared with antiarrhythmic drug treatment in cardiac arrest survivors (the Cardiac Arrest Study Hamburg). Am Heart J. 1994;127:1139–44.
6. Connolly SJ, Gent M, Roberts RS, et al. Canadian implantable defibrillator study (CIDS): a randomized trial of the implantable cardioverter defibrillator against amiodarone. Circulation. 2000;101:1297–302.
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8. Connolly SJ, Hallstrom AP, Cappato R, et al. Meta-analysis of the implantable cardioverter defibrillator secondary prevention trials. AVID, CASH and CIDS studies. Antiarrhythmics vs Implantable Defibrillator study. Cardiac Arrest Study Hamburg. Canadian Implantable Defibrillator Study. Eur Heart J. 2000;21:2071–8.
9. Cecchi F, Maron BJ, Epstein SE. Long-term outcome of patients with hypertrophic cardiomyopathy successfully resuscitated after cardiac arrest. J Am Coll Cardiol. 1989;13:1283– 8.
10. Elliott PM, Sharma S, Varnava A, et al. Survival after cardiac arrest or sustained ventricular tachycardia in patients with hypertrophic cardiomyopathy. J Am Coll Cardiol. 1999;33:1596 – 601.
11. Fananapazir L, Chang AC, Epstein SE, et al. Prognostic determinants in hypertrophic cardiomyopathy: prospective evaluation of a therapeutic strategy based on clinical, Holter, hemodynamic, and electrophysiological findings. Circulation. 1992;86:730 – 40
12. Maron BJ, Spirito P, Shen WK, et al. Implantable cardioverterdefibrillators and prevention of sudden cardiac death in hypertrophic cardiomyopathy. JAMA. 2007;298:405–12

Table 1.7 No Structural Heart Disease (LVEF ≥50%) or Known Genetic Causes of Sustained VT/VF

Pharmacologically Induced Sustained VT/VF
30. Non-torsades de pointes VT/VF in the setting of antiarrhythmia drug use
2008 DEVICE-BASED THERAPY GUIDELINES: **3. Recommendations for Implantable Cardioverter Defibrillators** CLASS III • ICD therapy is not indicated for patients with ventricular tachyarrhythmias due to a completely reversible disorder in the absence of structural heart disease (e.g., electrolyte imbalance, drugs, or trauma). (*Level of Evidence: B*) (2)
31. Drug induced torsades de pointes
2008 DEVICE-BASED THERAPY GUIDELINES: **3. Recommendations for Implantable Cardioverter Defibrillators** CLASS III • ICD therapy is not indicated for patients with ventricular tachyarrhythmias due to a completely reversible disorder in the absence of structural heart disease (e.g., electrolyte imbalance, drugs, or trauma). (*Level of Evidence: B*) (2)
Idiopathic VF With Normal Ventricular Function
32. No family history of sudden cardiac death
2008 DEVICE-BASED THERAPY GUIDELINES: **3. Recommendations for Implantable Cardioverter Defibrillators** CLASS I

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- ICD therapy is indicated in patients who are survivors of cardiac arrest due to VF or hemodynamically unstable sustained VT after evaluation to define the cause of the event and to exclude any completely reversible causes. (*Level of Evidence: A*) (2-8)

2006 VENTRICULAR ARRHYTHMIA GUIDELINES:

12.1. Idiopathic Ventricular Tachycardia

Class IIa

- 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 y. (*Level of Evidence: C*)

33. First degree relative with sudden cardiac death

2008 DEVICE-BASED THERAPY GUIDELINES:

CLASS I

- ICD therapy is indicated in patients who are survivors of cardiac arrest due to VF or hemodynamically unstable sustained VT after evaluation to define the cause of the event and to exclude any completely reversible causes. (*Level of Evidence: A*) (2-8)

2006 VENTRICULAR ARRHYTHMIA GUIDELINES:

12.1. Idiopathic Ventricular Tachycardia

Class IIa

- 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 y. (*Level of Evidence: C*)

Other Causes

34. Bradycardia dependent VT/VF

Not addressed in guidelines

35. WPW syndrome with VT/VF
    Pathway successfully ablated
    Structurally normal heart

2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

CLASS III

- ICD therapy is not indicated when VF or VT is amenable to surgical or catheter ablation (e.g., atrial arrhythmias associated with the Wolff-Parkinson-White syndrome, RV or LV outflow tract VT, idiopathic VT, or fascicular VT in the absence of structural heart disease). (*Level of Evidence: C*)

References:

1. Epstein AE, DiMarco JP, Ellenbogen KA, Estes NAM III, Freedman RA, Gettes LS, Gillinov AM, Gregoratos G, Hammill SC, Hayes DL, Hlatky MA, Newby LK, Page RL, Schoenfeld MH, Silka MJ, Stevenson LW, Sweeney MO. ACC/AHA/HRS 2008 guidelines for device-based therapy of cardiac rhythm abnormalities: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to Revise the ACC/AHA/NASPE 2002 Guideline Update for Implantation of Cardiac Pacemakers and Antiarrhythmia Devices). J Am Coll Cardiol 2008;51:e1–62.
2. 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. 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). J Am Coll Cardiol 2006;48:e247– e346.
3. The Antiarrhythmics versus Implantable Defibrillators (AVID) Investigators. A comparison of antiarrhythmic-drug therapy with implantable defibrillators in patients resuscitated from near-fatal ventricular arrhythmias. N Engl J Med. 1997;337:1576–83.

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4. Wever EF, Hauer RN, van Capelle FL, et al. Randomized study of implantable defibrillator as first-choice therapy versus conventional strategy in postinfarct sudden death survivors. Circulation. 1995;91: 2195–203.
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Table 1.8.1 Syncope in Patients Without Structural Heart Disease

Unexplained Syncope With No Structural Heart Disease or Genetically Transmitted Ventricular Arrhythmias
36. Normal ECG and structurally normal heart Family history of sudden death
2008 DEVICE-BASED THERAPY GUIDELINES: **3. Recommendations for Implantable Cardioverter Defibrillators** CLASS III • ICD therapy is not indicated for syncope of undetermined cause in a patient without inducible ventricular tachyarrhythmias and without structural heart disease. (*Level of Evidence: C*)
37. Normal ECG and structurally normal heart No known family history of sudden death
2008 DEVICE-BASED THERAPY GUIDELINES: **3. Recommendations for Implantable Cardioverter Defibrillators** CLASS III • ICD therapy is not indicated for syncope of undetermined cause in a patient without inducible ventricular tachyarrhythmias and without structural heart disease. (*Level of Evidence: C*)
Unexplained Syncope in a Patient With RV or LV Outflow Tract Tachycardia (Idiopathic VT) With Normal LV and RV Function and Anatomy
38. Documented sustained monomorphic VT (LBBB/inferior axis) at the time of syncope Ablation not yet attempted
2008 DEVICE-BASED THERAPY GUIDELINES: **3. Recommendations for Implantable Cardioverter Defibrillators** CLASS III • ICD therapy is not indicated when VF or VT is amenable to surgical or catheter ablation (e.g., atrial arrhythmias associated with the Wolff-Parkinson-White syndrome, RV or LV outflow tract VT, idiopathic VT, or fascicular VT in the absence of structural heart disease). (*Level of Evidence: C*)
39. Documented history of sustained monomorphic VT(LBBB/inferior axis) but not recorded at the time of syncope Ablation not yet attempted
2008 DEVICE-BASED THERAPY GUIDELINES: **3. Recommendations for Implantable Cardioverter Defibrillators** CLASS III • ICD therapy is not indicated when VF or VT is amenable to surgical or catheter ablation (e.g., atrial arrhythmias associated with the Wolff-Parkinson-White syndrome, RV or LV outflow tract VT, idiopathic VT, or fascicular VT in the absence of

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structural heart disease). (*Level of Evidence: C*)

40. Documented sustained monomorphic VT (LBBB/inferior axis) at the time of syncope
Ablation successful

2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

CLASS III

- ICD therapy is not indicated when VF or VT is amenable to surgical or catheter ablation (e.g., atrial arrhythmias associated with the Wolff-Parkinson-White syndrome, RV or LV outflow tract VT, idiopathic VT, or fascicular VT in the absence of structural heart disease). (*Level of Evidence: C*)

Unexplained Syncope in a Patient With Long QT Syndrome

41. While on treatment with beta blockers

2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

CLASS IIa

- ICD implantation is reasonable to reduce SCD in patients with long-QT syndrome who are experiencing syncope and/or VT while receiving beta blockers. (*Level of Evidence: B*) (3-8)

2006 VENTRICULAR ARRHYTHMIA GUIDELINES:

11.1.1. Long QT Syndrome

Class IIa

- 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 y. (*Level of Evidence: B*)

42. Not being treated with beta blockers

Not addressed in guidelines

Unexplained Syncope in a Patient With Brugada ECG Pattern

43. No EPS performed

Not addressed in guidelines

44. EPS performed
No ventricular arrhythmias induced

Not addressed in guidelines

45. EPS performed
Sustained VT/VF induced

Not addressed in guidelines

Unexplained Syncope in a Patient With Catecholaminergic Polymorphic VT

46. While on treatment with beta blockers

2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

CLASS IIa

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• ICD implantation is reasonable for patients with catecholaminergic polymorphic VT who have syncope and/or documented sustained VT while receiving beta blockers. (*Level of Evidence: C*) **2006 VENTRICULAR ARRHYTHMIA GUIDELINES:** **11.1.4. Catecholaminergic Polymorphic Ventricular Tachycardia** Class IIa • 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 y. (*Level of Evidence: C*)
47. Not being treated with beta blockers
Not addressed in guidelines

References:

1. Epstein AE, DiMarco JP, Ellenbogen KA, Estes NAM III, Freedman RA, Gettes LS, Gillinov AM, Gregoratos G, Hammill SC, Hayes DL, Hlatky MA, Newby LK, Page RL, Schoenfeld MH, Silka MJ, Stevenson LW, Sweeney MO. ACC/AHA/HRS 2008 guidelines for device-based therapy of cardiac rhythm abnormalities: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to Revise the ACC/AHA/NASPE 2002 Guideline Update for Implantation of Cardiac Pacemakers and Antiarrhythmia Devices). J Am Coll Cardiol 2008;51:e1–62.
2. 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. 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). J Am Coll Cardiol 2006;48:e247– e346.
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6. Monnig G, Kobe J, Loher A, et al. Implantable cardioverter defibrillator therapy in patients with congenital long-QT syndrome: a long-term follow-up. Heart Rhythm. 2005;2:497–504.
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9. *Joshi S, Wilber DJ. Ablation of idiopathic right ventricular outflow tract tachycardia: current perspectives; J Cardiovasc Electrophysiol. 2005 Sep;16 Suppl 1:S52-8. Review. – new reference added for round 2*

Table 1.8.2 Syncope in Patients With Coronary Artery Disease

Unexplained Syncope With Coronary Heart Disease and No Acute MI LVEF ≥50%
48. Electrophysiology study and noninvasive investigations failed to define a cause of syncope No prior MI Nonobstructive CAD; revascularization not indicated
Not addressed in guidelines
49. Electrophysiology study and noninvasive investigations failed to define a cause of syncope No prior MI Obstructive CAD; not amenable to revascularization
Not addressed in guidelines
Unexplained Syncope With Prior MI and No Acute MI LVEF 36-49%
50. Electrophysiology study failed to define a cause of syncope Nonobstructive CAD; revascularization not indicated
Not addressed in guidelines

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51. Electrophysiology study failed to define a cause of syncope
Obstructive CAD; not amenable to revascularization

2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

CLASS IIb

- ICD therapy may be considered in patients with syncope and advanced structural heart disease in whom thorough invasive and noninvasive investigations have failed to define a cause. (*Level of Evidence: C*)

52. Electrophysiology study revealed inducible sustained VT/VF

Not addressed in guidelines

Unexplained Syncope With Prior MI and No Acute MI
LVEF ≤35%

53. EPS not performed

2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

Class I

- ICD therapy is indicated in patient with LVEF less than or equal to 35% due to prior MI who are at least 40 days post-MI and are in NYHA functional Class II or III (*Level of Evidence: A*).
- ICD therapy is indicated 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%, and are in NYHA functional Class I (*Level of Evidence: A*).

Class IIa

- ICD implantation is reasonable for patients with unexplained syncope, significant LV dysfunction, and nonischemic DCM. (*Level of Evidence: C*)

CLASS IIb

- ICD therapy may be considered in patients with syncope and advanced structural heart disease in whom thorough invasive and noninvasive investigations have failed to define a cause. (*Level of Evidence: C*)

54. Inducible VT/VF at EPS

2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

Class I

- ICD therapy is indicated in patients with syncope of undetermined origin with clinically relevant, hemodynamically significant sustained VT or VF induced at electrophysiological study. (*Level of Evidence: B*) (2-3)

55. Not inducible at EPS

2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

Class I

- ICD therapy is indicated in patient with LVEF less than or equal to 35% due to prior MI who are at least 40 days post-MI and are in NYHA functional Class II or III (*Level of Evidence: A*).
- ICD therapy is indicated 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%, and are in NYHA functional Class I (*Level of Evidence: A*).

CLASS IIb

- ICD therapy may be considered in patients with syncope and advanced structural heart disease in whom thorough invasive

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and noninvasive investigations have failed to define a cause. (*Level of Evidence: C*)

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1. Epstein AE, DiMarco JP, Ellenbogen KA, Estes NAM III, Freedman RA, Gettes LS, Gillinov AM, Gregoratos G, Hammill SC, Hayes DL, Hlatky MA, Newby LK, Page RL, Schoenfeld MH, Silka MJ, Stevenson LW, Sweeney MO. ACC/AHA/HRS 2008 guidelines for device-based therapy of cardiac rhythm abnormalities: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to Revise the ACC/AHA/NASPE 2002 Guideline Update for Implantation of Cardiac Pacemakers and Antiarrhythmia Devices). J Am Coll Cardiol 2008;51:e1–62.
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3. Connolly SJ, Gent M, Roberts RS, et al. Canadian implantable defibrillator study (CIDS): a randomized trial of the implantable cardioverter defibrillator against amiodarone. Circulation. 2000;101:1297–302.

Table 1.8.3 Syncope in Patients With Nonischemic Structural Heart Disease

Unexplained Syncope in a Patient With Left Ventricular Hypertrophy Without Criteria for Hypertrophic Cardiomyopathy			
LVEF	**≥50%**	**36-49%**	**≤35%**
56. Left ventricular hypertrophy/hypertensive heart disease			
Not addressed in guidelines			
Unexplained Syncope in a Patient With Nonischemic Cardiomyopathy			
LVEF	**≥50%**	**36-49%**	**≤35%**
57. Nonischemic dilated cardiomyopathy			
2008 DEVICE-BASED THERAPY GUIDELINES: **3. Recommendations for Implantable Cardioverter Defibrillators** Class IIa • ICD implantation is reasonable for patients with unexplained syncope, significant LV dysfunction, and nonischemic DCM. (*Level of Evidence: C*) **2006 VENTRICULAR ARRHYTHMIA GUIDELINES:** **9.1. Dilated Cardiomyopathy (Nonischemic)** Class IIa • 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 y. (*Level of Evidence: C*) CLASS IIb • ICD therapy may be considered in patients with syncope and advanced structural heart disease in whom thorough invasive and noninvasive investigations have failed to define a cause. (*Level of Evidence: C*)			
LVEF	**≥50%**	**36-49%**	**≤35%**
58. Left ventricular non-compaction			
2008 DEVICE-BASED THERAPY GUIDELINES: **3. Recommendations for Implantable Cardioverter Defibrillators** Class IIa • ICD implantation is reasonable for patients with unexplained syncope, significant LV dysfunction, and nonischemic DCM			

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(*Level of Evidence: C*).

CLASS IIb

- ICD therapy may be considered for patients with a familial cardiomyopathy associated with sudden death (*Level of Evidence: C*).
- ICD therapy may be considered in patients with LV noncompaction. (*Level of Evidence: C*)

59. Hypertrophic cardiomyopathy

2008 DEVICE-BASED THERAPY GUIDELINES:

Class IIa

- ICD implantation is reasonable for patients with HCM who have 1 or more major risk factors for SCD (*Level of Evidence: C*).

2011 HYPERTROPHIC CARDIOMYOPATHY GUIDELINES:

2.14. Selection of Patients for ICDs—Recommendations

Class IIa

- It is reasonable to recommend an ICD for patients with HCM with:
    a. Sudden death presumably caused by HCM in 1 or more first-degree relatives. (5) *(Level of Evidence: C)*
    b. A maximum LV wall thickness greater than or equal to 30 mm. (6-9) *(Level of Evidence: C)*
    c. One or more recent, unexplained syncopal episodes. (10) *(Level of Evidence: C)*

60. Cardiac amyloidosis

Not addressed in guidelines

61. Tetrology of Fallot with prior corrective surgery

2008 Device Based Therapy Guidelines

CLASS IIa

- ICD implantation is reasonable for patients with congenital heart disease with recurrent syncope of undetermined origin in the presence of either ventricular dysfunction or inducible ventricular arrhythmias at electrophysiological study. (*Level of Evidence: B*) (11)

CLASS IIb

- ICD implantation may be considered for patients with recurrent syncope associated with complex congenital heart disease and advanced systemic ventricular dysfunction when thorough invasive and noninvasive investigations have failed to define a cause. (*Level of Evidence: C*) (12)

Unexplained Syncope in a Patient With Arrhythmogenic Right Ventricular Cardiomyopathy

62. No EPS performed

2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

Class IIa

- ICD implantation is reasonable for the prevention of SCD in patients with ARVD/C who have 1 or more risk factors for SCD (*Level of Evidence: C*).

2006 VENTRICULAR ARRHYTHMIA GUIDELINES:

9.3. Arrhythmogenic Right Ventricular Cardiomyopathy

Class IIa

- 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

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expectation of survival with a good functional status for more than 1 y. (*Level of Evidence: C*)

63. No inducible VT/VF at EPS

2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

Class IIa

- ICD implantation is reasonable for the prevention of SCD in patients with ARVD/C who have 1 or more risk factors for SCD (*Level of Evidence: C*).

2006 VENTRICULAR ARRHYTHMIA GUIDELINES:

9.3. Arrhythmogenic Right Ventricular Cardiomyopathy

Class IIa

- 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 y. (*Level of Evidence: C*)

64. Inducible VT/VF at EPS
    All inducible VTs successfully ablated

2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

Class I

- ICD therapy is indicated in patients with syncope of undetermined origin with clinically relevant, hemodynamically significant sustained VT or VF induced at electrophysiological study. (*Level of Evidence: B*) (2,4)

Class IIa

- ICD implantation is reasonable for the prevention of SCD in patients with ARVD/C who have 1 or more risk factors for SCD (*Level of Evidence: C*).

2006 VENTRICULAR ARRHYTHMIA GUIDELINES:

9.3. Arrhythmogenic Right Ventricular Cardiomyopathy

Class IIa

- 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 y. (*Level of Evidence: C*)

65. Inducible VT/VF at EPS
    Ablation unsuccessful

2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

Class I

- ICD therapy is indicated in patients with syncope of undetermined origin with clinically relevant, hemodynamically significant sustained VT or VF induced at electrophysiological study. (*Level of Evidence: B*) (2,4)

Class IIa

- ICD implantation is reasonable for the prevention of SCD in patients with ARVD/C who have 1 or more risk factors for SCD (*Level of Evidence: C*).

2006 VENTRICULAR ARRHYTHMIA GUIDELINES:

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9.3. Arrhythmogenic Right Ventricular Cardiomyopathy

Class IIa

- 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 y. (*Level of Evidence: C*)

References:

1. Epstein AE, DiMarco JP, Ellenbogen KA, Estes NAM III, Freedman RA, Gettes LS, Gillinov AM, Gregoratos G, Hammill SC, Hayes DL, Hlatky MA, Newby LK, Page RL, Schoenfeld MH, Silka MJ, Stevenson LW, Sweeney MO. ACC/AHA/HRS 2008 guidelines for device-based therapy of cardiac rhythm abnormalities: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to Revise the ACC/AHA/NASPE 2002 Guideline Update for Implantation of Cardiac Pacemakers and Antiarrhythmia Devices). J Am Coll Cardiol 2008;51:e1–62.
2. 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. 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). J Am Coll Cardiol 2006;48:e247– e346.
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4. Connolly SJ, Gent M, Roberts RS, et al. Canadian implantable defibrillator study (CIDS): a randomized trial of the implantable cardioverter defibrillator against amiodarone. Circulation. 2000;101:1297–302.
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9. Spirito P, Bellone P, Harris KM, et al. Magnitude of left ventricular hypertrophy and risk of sudden death in hypertrophic cardiomyopathy. N Engl J Med. 2000;342:1778–85.
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12. Ghai A, Silversides C, Harris L, Webb GD, Siu SC, Therrien J. Left ventricular dysfunction is a risk factor for sudden cardiac death in adults late after repair of tetralogy of Fallot. J Am Coll Cardiol. 2002;40:1675– 80.
13. *Bhonsale A, et al. Incidence and predictors of implantable cardioverter defibrillator therapy in patients with arrhythmogenic right ventricular dysplasia / cardiomyopathy undergoing implantable cardioverter-defibrillator implantation for primary prevention. JACC. 2011; 48: 1484-96.*
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Table 1.9 Sustained Hemodynamically Stable Monomorphic VT Associated With Structural Heart Disease

LVEF	≥50%	36-49%	≤35%
66. CAD and prior MI			
Not addressed in guidelines			
67. CAD and prior MI All inducible VTs successfully ablated			
Not addressed in guidelines			
68. CAD and prior MI Troponin elevation thought to be secondary to VT All inducible VTs successfully ablated			
Not addressed in guidelines			

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69. Nonischemic dilated cardiomyopathy
Not addressed in guidelines
70. Nonischemic dilated cardiomyopathy All inducible VTs successfully ablated
Not addressed in guidelines
71. Bundle branch reentry successfully ablated in a patient with nonischemic cardiomyopathy
2008 Device Based Therapy Guidelines Class III • ICD therapy is not indicated when VF or VT is amenable to surgical or catheter ablation (e.g., atrial arrhythmias associated with the Wolff-Parkinson-White syndrome, RV or LV outflow tract VT, idiopathic VT, or fascicular VT in the absence of structural heart disease). (*Level of Evidence: C*)

Reference:

1. Epstein AE, DiMarco JP, Ellenbogen KA, Estes NAM III, Freedman RA, Gettes LS, Gillinov AM, Gregoratos G, Hammill SC, Hayes DL, Hlatky MA, Newby LK, Page RL, Schoenfeld MH, Silka MJ, Stevenson LW, Sweeney MO. ACC/AHA/HRS 2008 guidelines for device-based therapy of cardiac rhythm abnormalities: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to Revise the ACC/AHA/NASPE 2002 Guideline Update for Implantation of Cardiac Pacemakers and Antiarrhythmia Devices). J Am Coll Cardiol 2008;51:e1–62.

Section 2: Primary Prevention

Table 2.1.1 Post Acute Myocardial Infarction (≤40 Days) LVEF ≤30%

Plan for Revascularization (Not Yet Performed)
72. No NSVT
Not addressed in guidelines
Revascularized After Acute MI
73. No NSVT
Not addressed in guidelines
74. Asymptomatic NSVT (>4 days post MI) No EPS performed
Not addressed in guidelines
75. Asymptomatic NSVT (>4 days post MI) EPS with inducible sustained VT (EPS performed after revascularization, within 30 days of MI)
2008 DEVICE-BASED THERAPY GUIDELINES: **3. Recommendations for Implantable Cardioverter Defibrillators** CLASS I • ICD therapy is indicated in patients with nonsustained VT due to prior MI, LVEF less than or equal to 40%, and inducible VF or sustained VT at electrophysiological study. (*Level of Evidence: B*) (2-4)

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76. Asymptomatic NSVT (>4 days post MI)
EPS with inducible sustained VT (EPS performed after revascularization, between 30 and 40 days after MI)

2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

CLASS I

- ICD therapy is indicated in patients with nonsustained VT due to prior MI, LVEF less than or equal to 40%, and inducible VF or sustained VT at electrophysiological study. (*Level of Evidence: B*) (2-4)

77. Asymptomatic NSVT (>4 days post MI)
EPS without inducible VT (EPS performed after revascularization, within 30 days after MI)

Not addressed in guidelines

78. Asymptomatic NSVT (>4 days post MI)
EPS without inducible VT (EPS performed after revascularization, between 30 and 40 days after MI)

Not addressed in guidelines

Not Revascularized
Obstructive CAD With Coronary Anatomy Not Amenable to Revascularization

79. No NSVT

Not addressed in guidelines

80. Asymptomatic NSVT (>4 days post MI)
No EPS performed

Not addressed in guidelines

81. Asymptomatic NSVT (>4 days post MI)
EPS with inducible sustained VT (EPS performed within 30 days of MI)

2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

CLASS I

- ICD therapy is indicated in patients with nonsustained VT due to prior MI, LVEF less than or equal to 40%, and inducible VF or sustained VT at electrophysiological study. (*Level of Evidence: B*) (2-4)

82. Asymptomatic NSVT (>4 days post MI)
EPS with inducible sustained VT (EPS performed between 30 and 40 days after MI)

2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

CLASS I

- ICD therapy is indicated in patients with nonsustained VT due to prior MI, LVEF less than or equal to 40%, and inducible VF or sustained VT at electrophysiological study. (*Level of Evidence: B*) (2-4)

83. Asymptomatic NSVT (>4 days post MI)
EPS without inducible VT (EPS performed within 30 days of MI)

Not addressed in guidelines

84. Asymptomatic NSVT (>4 days post MI)
EPS without inducible VT(EPS performed between 30 and 40 days after MI)

Not addressed in guidelines

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References:

1. Epstein AE, DiMarco JP, Ellenbogen KA, Estes NAM III, Freedman RA, Gettes LS, Gillinov AM, Gregoratos G, Hammill SC, Hayes DL, Hlatky MA, Newby LK, Page RL, Schoenfeld MH, Silka MJ, Stevenson LW, Sweeney MO. ACC/AHA/HRS 2008 guidelines for device-based therapy of cardiac rhythm abnormalities: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to Revise the ACC/AHA/NASPE 2002 Guideline Update for Implantation of Cardiac Pacemakers and Antiarrhythmia Devices). J Am Coll Cardiol 2008;51:e1–62.
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6. *Zaman S, Sivagangabalan G, Narayan A, et al. Outcomes of early risk stratification and targeted implantable cardioverter-defibrillator implantation after ST-elevation myocardial infarction treated with primary percutaneous coronary intervention. Circulation. 2009; 120: 194-200.*

Table 2.1.2 Post Acute Myocardial Infarction (≤40 Days) LVEF 31-40%

Revascularized for Acute MI
85. No NSVT
Not addressed in guidelines
86. Asymptomatic NSVT (>4 days post MI) No EPS performed
Not addressed in guidelines
87. Asymptomatic NSVT (>4 days post MI) EPS with inducible sustained VT (EPS performed after revascularization, within 30 days of MI)
2008 DEVICE-BASED THERAPY GUIDELINES: **3. Recommendations for Implantable Cardioverter Defibrillators** CLASS I • ICD therapy is indicated in patients with nonsustained VT due to prior MI, LVEF less than or equal to 40%, and inducible VF or sustained VT at electrophysiological study. (*Level of Evidence: B*) (2-4)
88. Asymptomatic NSVT (>4 days post MI) EPS with inducible sustained VT (EPS performed after revascularization, between 30 and 40 days after MI)
2008 DEVICE-BASED THERAPY GUIDELINES: **3. Recommendations for Implantable Cardioverter Defibrillators** CLASS I • ICD therapy is indicated in patients with nonsustained VT due to prior MI, LVEF less than or equal to 40%, and inducible VF or sustained VT at electrophysiological study. (*Level of Evidence: B*) (2-4)
89. Asymptomatic NSVT (>4 days post MI) EPS without inducible VT(EPS performed after revascularization, within 30 days of MI)
Not addressed in guidelines
90. Asymptomatic NSVT (>4 days post MI) EPS without inducible VT (EPS performed after revascularization, between 30 and 40 days after MI)
Not addressed in guidelines

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References:
1. Epstein AE, DiMarco JP, Ellenbogen KA, Estes NAM III, Freedman RA, Gettes LS, Gillinov AM, Gregoratos G, Hammill SC, Hayes DL, Hlatky MA, Newby LK, Page RL, Schoenfeld MH, Silka MJ, Stevenson LW, Sweeney MO. ACC/AHA/HRS 2008 guidelines for device-based therapy of cardiac rhythm abnormalities: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to Revise the ACC/AHA/NASPE 2002 Guideline Update for Implantation of Cardiac Pacemakers and Antiarrhythmia Devices). J Am Coll Cardiol 2008;51:e1–62.
2. Zipes DP, Camm AJ, Borggrefe M, et al. 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). J Am Coll Cardiol. 2006;48:e247– e346.
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Table 2.1.3 Post Acute Myocardial Infarction (≤40 days) and Pre-Existing Chronic Cardiomyopathy (≥3 Months)

91. LVEF ≤30% due to old infarction NYHA Class I
Not addressed in guidelines
92. LVEF ≤35% due to old infarction NYHA Class II-III
Not addressed in guidelines
93. LVEF ≤35% due to nonischemic causes NYHA Class II-III
Not addressed in guidelines

References: None

Table 2.1.4 Post Myocardial Infarction (≤40 days) and Need for Guideline-Directed Pacemaker Therapy Post-MI (e.g., SSS, CHB, or Other Indications for Permanent Pacemaker)

94. LVEF ≤35%
2004 STEMI GUIDELINES: **7.7.3.2.3. Pacing Mode Selection in STEMI Patients** Class I • All patients who have an indication for permanent pacing after STEMI should be evaluated for ICD indications. (*Level of Evidence: C*)
95. LVEF 36-40 %
2004 STEMI GUIDELINES: **7.7.3.2.3. Pacing Mode Selection in STEMI Patients** Class I • All patients who have an indication for permanent pacing after STEMI should be evaluated for ICD indications. (*Level of Evidence: C*)

Reference:
1. Antman EM, Anbe DT, Armstrong PW, Bates ER, Green LA, Hand M, Hochman JS, Krumholz HM, Kushner FG, Lamas GA, Mullany CJ, Ornato JP, Pearle DL, Sloan MA, Smith SC Jr. ACC/AHA guidelines for the management © 2004 by the American College of Cardiology Foundation and the American Heart Association, Inc. of patients with ST-elevation myocardial infarction: a report of the American College

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of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee to Revise the 1999 Guidelines for the Management of Patients With Acute Myocardial Infarction). 2004.

Table 2.2. Post Myocardial Infarction (>40 days) With Ischemic Cardiomyopathy

No Recent PCI or CABG (≤3 Months)					
96. LVEF ≤30%	NYHA Class	I	II	III	IV

2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

CLASS I

- ICD therapy is indicated in patients with LVEF less than or equal to 35% due to prior MI who are at least 40 days post-MI and are in NYHA functional Class II or III. (*Level of Evidence: A*) (4-5)
- ICD therapy is indicated 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%, and are in NYHA functional Class I. (*Level of Evidence: A*) (4,6)

2009 HEART FAILURE GUIDELINES:

4.2. Patients With Cardiac Structural Abnormalities or Remodeling Who Have Not Developed Heart Failure Symptoms (Stage B)

CLASS IIa

- Placement of an ICD is reasonable in patients with ischemic cardiomyopathy who are at least 40 days post-MI, have an LVEF of 30% or less, are NYHA functional class I on chronic optimal medical therapy, and have reasonable expectation of survival with a good functional status for more than 1 year. (*Level of Evidence: B*)

4.3.1. Patients With Reduced Left Ventricular Ejection Fraction

CLASS I

- Implantable cardioverter-defibrillator therapy is recommended for primary prevention of sudden cardiac death to reduce total mortality in patients with non-ischemic dilated cardiomyopathy or ischemic heart disease at least 40 days post-MI, a LVEF less than or equal to 35%, and NYHA functional class II or III symptoms while receiving chronic optimal medical therapy, and who have reasonable expectation of survival with a good functional status for more than 1 year (1, 5, 7-12). (*Level of Evidence: A*)

2006 VENTRICULAR ARRHYTHMIA GUIDELINES:

8.1. Left Ventricular Dysfunction Due to Prior Myocardial Infarction

Class I

- 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 d post-MI, have an LVEF less than or equal to 30% to 40%, 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 y. (*Level of Evidence: A*)

2004 STEMI GUIDELINES:

7.7.1.5. Implantable Cardioverter Defibrillator Implantation in Patients After STEMI

Class IIa

- If there is reduced LVEF (0.30 or less) at least 1 month post-STEMI and 3 months after coronary artery revascularization, it is reasonable to implant an ICD in post-STEMI patients without spontaneous VF or sustained VT more than 48 hours after STEMI. (*Level of Evidence: B*)

97. LVEF 31-35%	NYHA Class	I	II	III	IV

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2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

CLASS I

- ICD therapy is indicated in patients with LVEF less than or equal to 35% due to prior MI who are at least 40 days post-MI and are in NYHA functional Class II or III. (*Level of Evidence: A*) (4-5)

2009 HEART FAILURE GUIDELINES:

4.3.1. Patients With Reduced Left Ventricular Ejection Fraction

CLASS I

- Implantable cardioverter-defibrillator therapy is recommended for primary prevention of sudden cardiac death to reduce total mortality in patients with non-ischemic dilated cardiomyopathy or ischemic heart disease at least 40 days post-MI, a LVEF less than or equal to 35%, and NYHA functional class II or III symptoms while receiving chronic optimal medical therapy, and who have reasonable expectation of survival with a good functional status for more than 1 year (1, 5, 7-12). (*Level of Evidence: A*)

2006 VENTRICULAR ARRHYTHMIA GUIDELINES:

8.1. Left Ventricular Dysfunction Due to Prior Myocardial Infarction

Class I

- 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 d post-MI, have an LVEF less than or equal to 30% to 40%, 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 y. (*Level of Evidence: A*)

2004 STEMI GUIDELINES:

7.7.1.5. Implantable Cardioverter Defibrillator Implantation in Patients After STEMI

Class IIb

- The usefulness of an ICD is not well established in STEMI patients without spontaneous VF or sustained VT more than 48 hours after STEMI who have a reduced LVEF (0.31 to 0.40) at least 1 month after STEMI but who have no additional evidence of electrical instability (e.g., nonsustained VT). (*Level of Evidence: B*)

98. LVEF 36-40%
    Asymptomatic NSVT
    No EPS

2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

Class I

- ICD therapy is indicated in patients with nonsustained VT due to prior MI, LVEF less than or equal to 40%, and inducible VF or sustained VT at electrophysiological study. *(Level of Evidence: B)*

2006 VENTRICULAR ARRHYTHMIA GUIDELINES:

8.1. Left Ventricular Dysfunction Due to Prior Myocardial Infarction

Class I

- 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 d post-MI, have an LVEF less than or equal to 30% to 40%, 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 y. (*Level of Evidence: A*)

2004 STEMI GUIDELINES:

7.7.1.5. Implantable Cardioverter Defibrillator Implantation in Patients After STEMI

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Class IIb

- The usefulness of an ICD is not well established in STEMI patients without spontaneous VF or sustained VT more than 48 hours after STEMI who have a reduced LVEF (0.31 to 0.40) at least 1 month after STEMI and additional evidence of electrical instability (e.g., nonsustained VT) but who do not have inducible VF or sustained VT on EP testing. (*Level of Evidence: B*)

99. LVEF 36-40%
    Asymptomatic NSVT
    EPS without inducible VT/VF

2006 VENTRICULAR ARRHYTHMIA GUIDELINES:

8.1. Left Ventricular Dysfunction Due to Prior Myocardial Infarction

Class I

- 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 d post-MI, have an LVEF less than or equal to 30% to 40%, 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 y. (*Level of Evidence: A*)

2004 STEMI GUIDELINES:

7.7.1.5. Implantable Cardioverter Defibrillator Implantation in Patients After STEMI

Class IIb

- The usefulness of an ICD is not well established in STEMI patients without spontaneous VF or sustained VT more than 48 hours after STEMI who have a reduced LVEF (0.31 to 0.40) at least 1 month after STEMI and additional evidence of electrical instability (e.g., nonsustained VT) but who do not have inducible VF or sustained VT on EP testing. (*Level of Evidence: B*)

100. LVEF 36-40%
     Asymptomatic NSVT
     EPS with inducible sustained VT/VF

2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

CLASS I

- ICD therapy is indicated in patients with nonsustained VT due to prior MI, LVEF less than or equal to 40%, and inducible VF or sustained VT at electrophysiological study. (*Level of Evidence: B*) (4,13-14)

2006 VENTRICULAR ARRHYTHMIA GUIDELINES:

8.1. Left Ventricular Dysfunction Due to Prior Myocardial Infarction

Class I

- 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 d post-MI, have an LVEF less than or equal to 30% to 40%, 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 y. (*Level of Evidence: A*)

2004 STEMI GUIDELINES:

7.7.1.5. Implantable Cardioverter Defibrillator Implantation in Patients After STEMI

Class I

- An ICD is indicated for patients without spontaneous VF or sustained VT more than 48 hours after STEMI whose STEMI occurred at least 1 month previously, who have an LVEF between 0.31 and 0.40, demonstrate additional evidence of electrical instability (e.g., nonsustained VT), and have inducible VF or sustained VT on EP testing. (*Level of Evidence: B)*

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Recent PCI or CABG (≤3 Months)
101. No known pre-existing cardiomyopathy LVEF ≤35%
2008 DEVICE-BASED THERAPY GUIDELINES: **3. Recommendations for Implantable Cardioverter Defibrillators** CLASS I • ICD therapy is indicated in patients with LVEF less than or equal to 35% due to prior MI who are at least 40 days post-MI and are in NYHA functional Class II or III. (*Level of Evidence: A*) (4-5) • ICD therapy is indicated 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%, and are in NYHA functional Class I. (*Level of Evidence: A*) (4,6) **2009 HEART FAILURE GUIDELINES:** **4.3.1. Patients With Reduced Left Ventricular Ejection Fraction** CLASS I • Implantable cardioverter-defibrillator therapy is recommended for primary prevention of sudden cardiac death to reduce total mortality in patients with non-ischemic dilated cardiomyopathy or ischemic heart disease at least 40 days post-MI, a LVEF less than or equal to 35%, and NYHA functional class II or III symptoms while receiving chronic optimal medical therapy, and who have reasonable expectation of survival with a good functional status for more than 1 year (1, 5 7-12). (*Level of Evidence: A*)
102. Pre-existing documented cardiomyopathy LVEF ≤35% on guideline-directed medical therapy >3 months prior to PCI/CABG
2008 DEVICE-BASED THERAPY GUIDELINES: **Recommendations for Implantable Cardioverter Defibrillators** CLASS I • ICD therapy is indicated in patients with LVEF less than or equal to 35% due to prior MI who are at least 40 days post-MI and are in NYHA functional Class II or III. (*Level of Evidence: A*) (4-5) • ICD therapy is indicated 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%, and are in NYHA functional Class I. (*Level of Evidence: A*) (4,6) **2009 HEART FAILURE GUIDELINES:** **4.3.1. Patients With Reduced Left Ventricular Ejection Fraction** CLASS I • Implantable cardioverter-defibrillator therapy is recommended for primary prevention of sudden cardiac death to reduce total mortality in patients with non-ischemic dilated cardiomyopathy or ischemic heart disease at least 40 days post-MI, a LVEF less than or equal to 35%, and NYHA functional class II or III symptoms while receiving chronic optimal medical therapy, and who have reasonable expectation of survival with a good functional status for more than 1 year (1, 5 7-12). (*Level of Evidence: A*) **2006 VENTRICULAR ARRHYTHMIA GUIDELINES:** **8.1. Left Ventricular Dysfunction Due to Prior Myocardial Infarction** Class IIa • Implantation of an ICD is reasonable in patients with LV dysfunction due to prior MI who are at least 40 d 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*)
103. LVEF ≤35% Need for ppm post-revascularization (e.g., SSS, CHB, or other guideline-directed indications for permanent pacemaker)

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2008 DEVICE-BASED THERAPY GUIDELINES:

Recommendations for Implantable Cardioverter Defibrillators

CLASS I

- ICD therapy is indicated in patients with LVEF less than or equal to 35% due to prior MI who are at least 40 days post-MI and are in NYHA functional Class II or III. (*Level of Evidence: A*) (4-5)
- ICD therapy is indicated 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%, and are in NYHA functional Class I. (*Level of Evidence: A*) (4,6)

2009 HEART FAILURE GUIDELINES:

4.3.1. Patients With Reduced Left Ventricular Ejection Fraction

CLASS I

- Implantable cardioverter-defibrillator therapy is recommended for primary prevention of sudden cardiac death to reduce total mortality in patients with non-ischemic dilated cardiomyopathy or ischemic heart disease at least 40 days post-MI, a LVEF less than or equal to 35%, and NYHA functional class II or III symptoms while receiving chronic optimal medical therapy, and who have reasonable expectation of survival with a good functional status for more than 1 year (1, 5 7-12). (*Level of Evidence: A*)

2004 STEMI GUIDELINES:

7.7.3.2.3. Pacing Mode Selection in STEMI Patients

Class I

- All patients who have an indication for permanent pacing after STEMI should be evaluated for ICD indications. (*Level of Evidence: C*)

104. LVEF 36-40%
Need for ppm post-revascularization (e.g., SSS, CHB, or other guideline-directed indications for permanent pacemaker)

2006 VENTRICULAR ARRHYTHMIA GUIDELINES:

10. Heart Failure

Class I

- 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 d 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 y. (*Level of Evidence: A*)

2004 STEMI GUIDELINES:

7.7.3.2.3. Pacing Mode Selection in STEMI Patients

Class I

- All patients who have an indication for permanent pacing after STEMI should be evaluated for ICD indications. (*Level of Evidence: C*)

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Table 2.3 Duration of Guideline-Directed Medical Therapy for Ischemic Cardiomyopathy Without Recent MI (Revascularization Not Indicated)

105. LVEF ≤35% On guideline-directed medical therapy for <3 months
Not addressed in guidelines
106. LVEF ≤35% On guideline-directed medical therapy <3 months NSVT EPS with inducible sustained VT
2008 DEVICE-BASED THERAPY GUIDELINES: **Recommendations for Implantable Cardioverter Defibrillators** CLASS I • ICD therapy is indicated in patients with nonsustained VT due to prior MI, LVEF less than or equal to 40%, and inducible VF or sustained VT at electrophysiological study. (*Level of Evidence: B*) (3,6-7)
107. LVEF ≤35% On guideline-directed medical therapy ≥3 months
2008 DEVICE-BASED THERAPY GUIDELINES: **Recommendations for Implantable Cardioverter Defibrillators** CLASS I • ICD therapy is indicated in patients with LVEF less than or equal to 35% due to prior MI who are at least 40 days post-MI and are in NYHA functional Class II or III. (*Level of Evidence: A*) (3-4) • ICD therapy is indicated 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%, and are in NYHA functional Class I. (*Level of Evidence: A*) (3,5) **2009 HEART FAILURE GUIDELINES:** **4.3.1. Patients With Reduced Left Ventricular Ejection Fraction**

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CLASS I

- Implantable cardioverter-defibrillator therapy is recommended for primary prevention of sudden cardiac death to reduce total mortality in patients with non-ischemic dilated cardiomyopathy or ischemic heart disease at least 40 days post-MI, a LVEF less than or equal to 35%, and NYHA functional class II or III symptoms while receiving chronic optimal medical therapy, and who have reasonable expectation of survival with a good functional status for more than 1 year (1, 4, 8-12). (*Level of Evidence: A*)

2006 VENTRICULAR ARRHYTHMIA GUIDELINES:

8.1. Left Ventricular Dysfunction Due to Prior Myocardial Infarction

Class I

- 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 d post-MI, have an LVEF less than or equal to 30% to 40%, 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 y. (*Level of Evidence: A*)

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Table 2.4 Nonischemic Cardiomyopathy

Treatment Since Diagnosis <3 Months Newly Diagnosed and Narrow QRS				
108. LVEF ≤30%	NYHA Class	I	II-III	IV

2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

CLASS I

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- ICD therapy is indicated in patients with nonischemic DCM who have an LVEF less than or equal to 35% and who are in NYHA functional Class II or III. (*Level of Evidence: B*) (3-6)

CLASS IIb

- ICD therapy may be considered in patients with nonischemic heart disease who have an LVEF of less than or equal to 35% and who are in NYHA functional Class I. (*Level of Evidence: C*)

109. LVEF 31-35%	NYHA Class	I	II-III	IV

2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

CLASS I

- ICD therapy is indicated in patients with nonischemic DCM who have an LVEF less than or equal to 35% and who are in NYHA functional Class II or III. (*Level of Evidence: B*) (3-6)

CLASS IIb

- ICD therapy may be considered in patients with nonischemic heart disease who have an LVEF of less than or equal to 35% and who are in NYHA functional Class I. (*Level of Evidence: C*)

At Least 3 Months on Guideline-Directed Medical Therapy				
110. LVEF ≤30%	NYHA Class	I	II-III	IV

2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

CLASS I

- ICD therapy is indicated in patients with nonischemic DCM who have an LVEF less than or equal to 35% and who are in NYHA functional Class II or III. (*Level of Evidence: B*) (3-6)

CLASS IIb

- ICD therapy may be considered in patients with nonischemic heart disease who have an LVEF of less than or equal to 35% and who are in NYHA functional Class I. (*Level of Evidence: C*)

2009 HEART FAILURE GUIDELINES:

4.2. Patients With Cardiac Structural Abnormalities or Remodeling Who Have Not Developed Heart Failure Symptoms (Stage B)

CLASS IIb

- Placement of an ICD might be considered in patients without HF who have nonischemic cardiomyopathy and an LVEF less than or equal to 30% who are in NYHA functional class I with chronic optimal medical therapy and have a reasonable expectation of survival with good functional status for more than 1 year. (*Level of Evidence: C*)

4.3.1. Patients With Reduced Left Ventricular Ejection Fraction

CLASS I

- Implantable cardioverter-defibrillator therapy is recommended for primary prevention of sudden cardiac death to reduce total mortality in patients with non-ischemic dilated cardiomyopathy or ischemic heart disease at least 40 days post-MI, a LVEF less than or equal to 35%, and NYHA functional class II or III symptoms while receiving chronic optimal medical therapy, and who have reasonable expectation of survival with a good functional status for more than 1 year (1, 4, 9-12). (*Level of Evidence: A*)

2006 VENTRICULAR ARRHYTHMIA GUIDELINES:

9.1. Dilated Cardiomyopathy (Nonischemic)

Class I

- ICD therapy is recommended for primary prevention to reduce total mortality by a reduction in SCD in patients with

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nonischemic DCM who have an 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 y. (*Level of Evidence: B*)

111. LVEF 31-35%	NYHA Class	I	II-III	IV

2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

CLASS I

- ICD therapy is indicated in patients with nonischemic DCM who have an LVEF less than or equal to 35% and who are in NYHA functional Class II or III. (*Level of Evidence: B*) (3-6)

CLASS IIb

- ICD therapy may be considered in patients with nonischemic heart disease who have an LVEF of less than or equal to 35% and who are in NYHA functional Class I. (*Level of Evidence: C*)

2009 HEART FAILURE GUIDELINES:

4.3.1. Patients With Reduced Left Ventricular Ejection Fraction

CLASS I

- Implantable cardioverter-defibrillator therapy is recommended for primary prevention of sudden cardiac death to reduce total mortality in patients with non-ischemic dilated cardiomyopathy or ischemic heart disease at least 40 days post-MI, a LVEF less than or equal to 35%, and NYHA functional class II or III symptoms while receiving chronic optimal medical therapy, and who have reasonable expectation of survival with a good functional status for more than 1 year (1, 4, 9-12). (*Level of Evidence: A*)

2006 VENTRICULAR ARRHYTHMIA GUIDELINES:

9.1. Dilated Cardiomyopathy (Nonischemic)

Class I

- ICD therapy is recommended for primary prevention to reduce total mortality by a reduction in SCD in patients with nonischemic DCM who have an 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 y. (*Level of Evidence: B*)

112. LVEF 36-40%
Not addressed in guidelines

Recent Valve Surgery (Same Hospitalization, i.e., ≤3 Months) Which Included Incidental Bypass Graft
113. LVEF ≤35% Need for pacemaker and LV function not felt likely to improve
Not addressed in guidelines

Specific Etiologies			
114. Sarcoid heart disease	EF	≤35%	>35%

2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

CLASS IIa

- ICD implantation is reasonable for patients with cardiac sarcoidosis, giant cell myocarditis, or Chagas disease. (*Level of Evidence: C*)

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115. Myotonic dystrophy	EF	≤35%	>35%

2008 DEVICE BASED THERAPY GUIDELINES:

2.1.2 Acquired atrioventricular block in adults

Class I

- Permanent pacemaker implantation is indicated for third-degree and advanced second-degree AV block at any anatomic level associated with neuromuscular diseases with AV block, such as myotonic muscular dystrophy, Kearns-Sayre syndrome, Erb dystrophy (limb-girdle muscular dystrophy), and peroneal muscular atrophy, with or without symptoms. (Level of Evidence: B) (13-19)

116. Chagas disease	EF	≤35%	>35%

2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

CLASS IIa

- ICD implantation is reasonable for patients with cardiac sarcoidosis, giant cell myocarditis, or Chagas disease. (*Level of Evidence: C*)

117. Amyloidosis with heart failure	EF	≤35%	>35%

Not addressed in guidelines

118. Acute lymphocytic myocarditis Newly diagnosed (<3 months ago)	EF	≤35%	>35%

2006 VENTRICULAR ARRHYTHMIA GUIDELINES:

8.4.1. Myocarditis, Rheumatic Disease, and Endocarditis

Class III

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

119. Giant cell myocarditis	EF	≤35%	>35%

2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

CLASS IIa

- ICD implantation is reasonable for patients with cardiac sarcoidosis, giant cell myocarditis, or Chagas disease. (*Level of Evidence: C*)

120. Peripartum cardiomyopathy Persists >3 months postpartum	EF	≤35%	>35%

Not addressed in guidelines

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Table 2.5 Genetic Conditions (Excludes Syncope and Sustained VT, Covered in Section 1)

121. Hypertrophic cardiomyopathy with 1 or more risk factors
<u>2008 DEVICE-BASED THERAPY GUIDELINES:</u> **3. Recommendations for Implantable Cardioverter Defibrillators** CLASS IIa • ICD implantation is reasonable for patients with HCM who have 1 or more major risk factors for SCD. (*Level of Evidence: C*) **<u>2011 HYPERTROPHIC CARDIOMYOPATHY GUIDELINES:</u>**

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2.14. Selection of Patients for ICDs—Recommendations

Class IIa

- It is reasonable to recommend an ICD for patients with HCM with:
    a. Sudden death presumably caused by HCM in 1 or more first-degree relatives. (4) *(Level of Evidence: C)*
    b. A maximum LV wall thickness greater than or equal to 30 mm. (5-8) *(Level of Evidence: C)*
    c. One or more recent, unexplained syncopal episodes. (9) *(Level of Evidence: C)*

2006 VENTRICULAR ARRHYTHMIA GUIDELINES:

9.2. Hypertrophic Cardiomyopathy

Class IIa

- ICD implantation can be effective for primary prophylaxis against SCD in patients with HCM who have 1 or more major risk factor 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 y. (*Level of Evidence: C*)

122. Arrhythmogenic right ventricular dysplasia/cardiomyopathy with no symptoms due to arrhythmia

2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

CLASS IIa

- ICD implantation is reasonable for the prevention of SCD in patients with ARVD/C who have 1 or more risk factors for SCD. (*Level of Evidence: C*)

2006 VENTRICULAR ARRHYTHMIA GUIDELINES:

9.3. Arrhythmogenic Right Ventricular Cardiomyopathy

Class IIa

- 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 y. (*Level of Evidence: C*)

Congenital Long QT Syndrome With 1 or More Risk Factors

123. Not receiving guideline-directed medical therapy

2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

CLASS IIb

- ICD therapy may be considered for patients with long-QT syndrome and risk factors for SCD. (*Level of Evidence: B*) (2,10-15)

124. Receiving guideline-directed therapy

2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

CLASS IIb

- ICD therapy may be considered for patients with long-QT syndrome and risk factors for SCD. (*Level of Evidence: B*) (2,10-15)

2006 VENTRICULAR ARRHYTHMIA GUIDELINES:

11.1.1. Long QT Syndrome

Class IIb

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- 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 y. (*Level of Evidence: B*)

Catecholaminergic Polymorphic VT With Nonsustained VT (Without Syncope)

125. Not receiving beta blockers, flecainide, or propafenone

Not addressed in guidelines

126. Receiving beta blockers

Not addressed in guidelines

127. Not tolerating or breakthrough nonsustained ventricular arrhythmias on beta blockers

Not addressed in guidelines

Incidentally Discovered Brugada by ECG (Type I ECG Pattern) In the Absence of Symptoms or Family History of Sudden Cardiac Death

128. No EPS

Not addressed in guidelines

129. Inducible VT or VF at EPS

2006 VENTRICULAR ARRHYTHMIA GUIDELINES:

11.1.3 Brugada Syndrome

Class IIb

- 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*).

130. No inducible VT or VF at EPS

Not addressed in guidelines

Familial Dilated/Nonischemic Cardiomyopathy (RV/LV) Associated With Sudden Cardiac Death

131. Evidence of structural cardiac disease but LVEF >35%

2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

CLASS IIb

- ICD therapy may be considered in patients with a familial cardiomyopathy associated with sudden death. (*Level of Evidence: C*)

132. Normal ECG and echo but carrying the implicated gene

2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

CLASS IIb

- ICD therapy may be considered in patients with a familial cardiomyopathy associated with sudden death. (*Level of Evidence: C*)

133. LV non-compaction with LVEF >35%

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2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

CLASS IIb

- ICD therapy may be considered in patients with a familial cardiomyopathy associated with sudden death. (*Level of Evidence: C*)
- ICD therapy may be considered in patients with LV noncompaction. (*Level of Evidence: C*)

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Section 3. Comorbidities

It should be noted that the scenarios in this section refer to ICDs implanted for PRIMARY PREVENTION.

Table 3.1 Special Conditions/Comorbidities in Patients for Primary Prevention (Meeting Indications of ICD Implant Related to HF Diagnosis With EF ≤30% on Guideline-Directed Medical Therapy >3 Months)

Life Expectancy					
134. Life expectancy <1 year from cardiac or noncardiac conditions					
2008 DEVICE-BASED THERAPY GUIDELINES: **3. Recommendations for Implantable Cardioverter Defibrillators** CLASS III • ICD therapy is not indicated for patients who do not have a reasonable expectation of survival with an acceptable functional status for at least 1 year, even if they meet ICD implantation criteria specified in the Class I, IIa, and IIb recommendations above. (*Level of Evidence: C)* **2009 HEART FAILURE GUIDELINES:** **4.3.1. Patients With Reduced Left Ventricular Ejection Fraction** **7. End-of-Life Considerations** CLASS III • Aggressive procedures performed within the final days of life (including intubation and implantation of a cardioverter-defibrillator in patients with NYHA functional class IV symptoms who are not anticipated to experience clinical improvement from available treatments) are not appropriate. (*Level of Evidence: C)* **2006 VENTRICULAR ARRHYTHMIA GUIDELINES:** **13.3. Elderly Patients** Class III • Elderly patients with projected life expectancy less than 1 y due to major comorbidities should not receive ICD therapy. (*Level of Evidence: C*)					
135. Noncardiac disease with life expectancy 1-2 years					
Not addressed in guidelines					
Elderly					
136. 80-89 years old	NYHA Class	I	II	III	IV
2006 VENTRICULAR ARRHYTHMIA GUIDELINES: **13.3. Elderly Patients** Class III • Elderly patients with projected life expectancy less than 1 y due to major comorbidities should not receive ICD therapy. (*Level of Evidence: C*)					

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137. ≥90 years old	NYHA Class	I	II	III	IV

2006 VENTRICULAR ARRHYTHMIA GUIDELINES:

13.3. Elderly Patients

Class III

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

Cognitive Impairment

138. Not able to understand or provide informed consent
Health care proxy consents to ICD

Not addressed in guidelines

139. Not able to understand or provide informed consent
No health care proxy can be identified

Not addressed in guidelines

Advanced Psychiatric Impairment

140. Significant psychiatric illnesses that may be aggravated by device implantation or that may preclude regular follow-up

2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

CLASS III

- ICD therapy is not indicated in patients with significant psychiatric illnesses that may be aggravated by device implantation or that may preclude systematic follow-up. (*Level of Evidence: C)*

Renal Disease

141. Severe symptomatic peripheral vascular disease (e.g., peripheral interventions or clinical claudication)	NYHA Class	I	II	III	IV

Not addressed in guidelines

142. Chronic kidney disease on dialysis Not a candidate for renal transplant	NYHA Class	I	II	III	IV

2006 VENTRICULAR ARRHYTHMIA GUIDELINES:

8.4.4. End-Stage Renal Failure

Class I

- 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 y. (*Level of Evidence: C*)

143. Chronic kidney disease with CrCl <30 cc, not yet on dialysis but candidate for dialysis	NYHA Class	I	II	III	IV

2006 VENTRICULAR ARRHYTHMIA GUIDELINES:

8.4.4. End-Stage Renal Failure

Class I

- Life-threatening ventricular arrhythmias, especially in patients awaiting renal transplantation, should be treated

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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 y. (*Level of Evidence: C*)

Other Comorbidities

144. IV drug abuse (ongoing)

Not addressed in guidelines

145. Unresolved infection associated with risk for hematogenous seeding

Not addressed in guidelines

146. Non-compliance with medical therapy and follow-up

Not addressed in guidelines

Class IV Heart Failure

147. On waiting list for heart transplant

2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

CLASS IIa

- ICD implantation is reasonable for non hospitalized patients awaiting transplantation. (*Level of Evidence: C*)

148. Not candidate for cardiac transplantation, CRT, or VAD
Refractory symptoms on oral therapy

2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

CLASS III

- ICD therapy is not indicated for NYHA Class IV patients with drug-refractory congestive heart failure who are not candidates for cardiac transplantation or CRT-D. (*Level of Evidence: C)*

2009 HEART FAILURE GUIDELINES:

7. End-of-Life Considerations

CLASS III

- Aggressive procedures performed within the final days of life (including intubation and implantation of a cardioverter-defibrillator in patients with NYHA functional class IV symptoms who are not anticipated to experience clinical improvement from available treatments) are not appropriate. (*Level of Evidence: C)*

149. Patient with a VAD

Not addressed in guidelines

150. Not a candidate for transplant or VAD
Does not meet CRT criteria
Planned outpatient continuous intravenous inotropic therapy for palliation

2008 DEVICE-BASED THERAPY GUIDELINES:

3. Recommendations for Implantable Cardioverter Defibrillators

CLASS III

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- ICD therapy is not indicated for NYHA Class IV patients with drug-refractory congestive heart failure who are not candidates for cardiac transplantation or CRT-D. (*Level of Evidence: C)*

References:

1. Epstein AE, DiMarco JP, Ellenbogen KA, Estes NAM III, Freedman RA, Gettes LS, Gillinov AM, Gregoratos G, Hammill SC, Hayes DL, Hlatky MA, Newby LK, Page RL, Schoenfeld MH, Silka MJ, Stevenson LW, Sweeney MO. ACC/AHA/HRS 2008 guidelines for device-based therapy of cardiac rhythm abnormalities: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to Revise the ACC/AHA/NASPE 2002 Guideline Update for Implantation of Cardiac Pacemakers and Antiarrhythmia Devices). J Am Coll Cardiol 2008;51:e1–62.
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Section 4. ICD Generator Replacement at ERI

Table 4.1 Primary Prevention ICD at Initial Implant

No Clinically Relevant Ventricular Arrhythmias on ICD Since Implant		
151. Patient received primary prevention ICD when LVEF was ≤35% LVEF now unchanged		
Not addressed in guidelines		
152. Patient received primary prevention ICD when LVEF was ≤35% LVEF now 36-49%		
Not addressed in guidelines		
153. Patient received primary prevention ICD when LVEF was ≤35% LVEF now ≥50% (normalized)		
Not addressed in guidelines		
No Clinically Relevant Ventricular Arrhythmias on ICD Since Implant (Now Has Prognosis <1 Year)		
154. Patient received primary prevention ICD Pacemaker dependent	Replace with ICD	Replace with Pacemaker
Not addressed in guidelines		
155. Patient received primary prevention ICD Not pacemaker dependent		
Not addressed in guidelines		
Clinically Relevant Ventricular Arrhythmias on ICD Since Implant		
156. Patient received primary prevention ICD when LVEF was ≤35% LVEF now unchanged		
Not addressed in guidelines		
157. Patient received primary prevention ICD when LVEF was ≤35% LVEF now 36-49%		
Not addressed in guidelines		
158. Patient received primary prevention ICD when LVEF was ≤35% LVEF now ≥50% (normalized)		
Not addressed in guidelines		
159. Patient received primary prevention ICD Now has prognosis <1 year		
Not addressed in guidelines		

References:

1. *Kramer DM, Buxton AE, Zimetbaum PJ. Time for a change – A new approach to ICD replacement. N Engl J Med. 2012; 366: 291-3.*
2. *Poole JE, Gleva MJ, Mela T, et al. Complication rates associated with pacemaker or implantable cardioverter-defibrillator generator replacements and upgrade procedures: results from the REPLACE registry. Circulation 2010;122:1553-61.*
3. *Lampert R, Hayes DL, Annas GJ, et al. HRS Expert Consensus Statement on the Management of Cardiovascular Implantable Electronic Devices (CIEDs) in patients nearing end of life or requesting withdrawal of therapy. Heart Rhythm 2010;7:1008-26.*
4. *Kramer DB, Kesselheim AS, Brock DW, Maisel WH. Ethical and legal views of physicians regarding deactivation of cardiac implantable electrical devices: a quantitative assessment. Heart Rhythm 2010;7:1537-42.*

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Table 4.2 Secondary Prevention ICD at Initial Implant

160. Patient received secondary prevention ICD No ventricular arrhythmia since initial implant
Not addressed in guidelines
161. Patient received secondary prevention ICD Had ventricular tachyarrhythmias in the monitor zone lasting >30 seconds, but no treated ventricular arrhythmias since initial implant
Not addressed in guidelines
162. Patient received secondary prevention ICD Had ventricular arrhythmias receiving ICD therapy since implant
Not addressed in guidelines

References:

1. *Kramer DM, Buxton AE, Zimetbaum PJ. Time for a change – A new approach to ICD replacement. N Engl J Med. 2012; 366: 291-3.*
2. *Poole JE, Gleva MJ, Mela T, et al. Complication rates associated with pacemaker or implantable cardioverter-defibrillator generator replacements and upgrade procedures: results from the REPLACE registry. Circulation 2010;122:1553-61.*
3. *Lampert R, Hayes DL, Annas GJ, et al. HRS Expert Consensus Statement on the Management of Cardiovascular Implantable Electronic Devices (CIEDs) in patients nearing end of life or requesting withdrawal of therapy. Heart Rhythm 2010;7:1008-26.*
4. *Kramer DB, Kesselheim AS, Brock DW, Maisel WH. Ethical and legal views of physicians regarding deactivation of cardiac implantable electrical devices: a quantitative assessment. Heart Rhythm 2010;7:1537-42.*

Table 4.3 Primary Prevention at Initial Implant: Replacement of CRT-ICD for ERI

Primary Prevention at Initial Implant: Replacement of CRT-ICD for ERI	Replace With CRT-ICD	Replace With CRT-Pacemaker
163. Patient got a CRT-ICD when LVEF was ≤35% LVEF now unchanged (despite clinical improvement)		
Not addressed in guidelines		
164. Patient got a CRT-ICD when LVEF was ≤35% LVEF now 36-49%		
Not addressed in guidelines		
165. Patient got a CRT-ICD when LVEF was ≤35% LVEF now ≥50% (normalized)		
Not addressed in guidelines		

References:

1. *Kramer DM, Buxton AE, Zimetbaum PJ. Time for a change – A new approach to ICD replacement. N Engl J Med. 2012; 366: 291-3.*
2. *Poole JE, Gleva MJ, Mela T, et al. Complication rates associated with pacemaker or implantable cardioverter-defibrillator generator replacements and upgrade procedures: results from the REPLACE registry. Circulation 2010;122:1553-61.*
3. *Lampert R, Hayes DL, Annas GJ, et al. HRS Expert Consensus Statement on the Management of Cardiovascular Implantable Electronic Devices (CIEDs) in patients nearing end of life or requesting withdrawal of therapy. Heart Rhythm 2010;7:1008-26.*
4. *Kramer DB, Kesselheim AS, Brock DW, Maisel WH. Ethical and legal views of physicians regarding deactivation of cardiac implantable electrical devices: a quantitative assessment. Heart Rhythm 2010;7:1537-42.*

Table 4.4 Secondary Prevention at Initial Implant: Replacement of CRT-ICD for ERI

Secondary Prevention at Initial Implant: Replacement of CRT-ICD for ERI	Replace With CRT-ICD	Replace With CRT-Pacemaker
166. Patient got a CRT-ICD when LVEF was ≤35% LVEF now unchanged (despite clinical improvement)		

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Not addressed in guidelines
167. Patient got a CRT-ICD when LVEF was ≤35% LVEF now 36-49%
Not addressed in guidelines
168. Patient got a CRT-ICD when LVEF was ≤35% LVEF now ≥50% (normalized)
Not addressed in guidelines

References:

1. *Kramer DM, Buxton AE, Zimetbaum PJ. Time for a change – A new approach to ICD replacement. N Engl J Med. 2012; 366: 291-3.*
2. *Poole JE, Gleva MJ, Mela T, et al. Complication rates associated with pacemaker or implantable cardioverter-defibrillator generator replacements and upgrade procedures: results from the REPLACE registry. Circulation 2010;122:1553-61.*
3. *Lampert R, Hayes DL, Annas GJ, et al. HRS Expert Consensus Statement on the Management of Cardiovascular Implantable Electronic Devices (CIEDs) in patients nearing end of life or requesting withdrawal of therapy. Heart Rhythm 2010;7:1008-26.*
4. *Kramer DB, Kesselheim AS, Brock DW, Maisel WH. Ethical and legal views of physicians regarding deactivation of cardiac implantable electrical devices: a quantitative assessment. Heart Rhythm 2010;7:1537-42.*

Section 5. Dual Chamber ICD

(as opposed to single chamber ICD for patients who meet criteria for ICD implantation)

It should be noted that there are no specific guidelines for single versus dual chamber pacing in patients undergoing ICD implantation. The device guidelines below refer to indications for ***permanent pacemaker*** implantation. It is an assumed that patients who meet indications for dual chamber pacemaker implantation would also meet criteria for dual chamber ICDs.

Table 5.1 Conduction System Abnormalities

Conduction System Abnormalities Patient With Sinus Node Dysfunction Who Meets Criteria for ICD
169. Sinus node dysfunction (includes sinus pauses, chronotropic incompetence, or marked sinus bradycardia that results from drug therapy required to treat other conditions) Symptomatic
2008 DEVICE-BASED THERAPY GUIDELINES: **2.1.1 Recommendations for Permanent Pacing in Sinus Node Dysfunction** CLASS I • Permanent pacemaker implantation is indicated for SND with documented symptomatic bradycardia, including frequent sinus pauses that produce symptoms. *(Level of Evidence: C)* (3-5) • Permanent pacemaker implantation is indicated for symptomatic chronotropic incompetence. *(Level of Evidence: C)* (3-7) • Permanent pacemaker implantation is indicated for symptomatic sinus bradycardia that results from required drug therapy for medical conditions. *(Level of Evidence: C)*
170. Resting sinus bradycardia (resting heart rate <50 bpm) Asymptomatic
2008 DEVICE-BASED THERAPY GUIDELINES: **2.1.1 Recommendations for Permanent Pacing in Sinus Node Dysfunction** CLASS III • Permanent pacemaker implantation is not indicated for SND in asymptomatic patients. *(Level of Evidence: C)*

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- Permanent pacemaker implantation is not indicated for SND in patients for whom the symptoms suggestive of bradycardia have been clearly documented to occur in the absence of bradycardia. *(Level of Evidence: C)*

Conduction System Abnormalities
Patient With AV Conduction Disease Who Meets Criteria for ICD (Narrow QRS <120 msec)

171. Third degree AV block or advanced second degree AV block (Mobitz II AV block or high degree AV block)
Symptomatic
CRT not indicated

2008 DEVICE-BASED THERAPY GUIDELINES:

2.1.2 Recommendations for Acquired Atrioventricular Block in Adults

CLASS I

- Permanent pacemaker implantation is indicated for third-degree and advanced second-degree AV block at any anatomic level associated with bradycardia with symptoms (including heart failure) or ventricular arrhythmias presumed to be due to AV block. *(Level of Evidence: C)* (8-11)
- Permanent pacemaker implantation is indicated for third-degree and advanced second-degree AV block at any anatomic level associated with arrhythmias and other medical conditions that require drug therapy that results in symptomatic bradycardia. *(Level of Evidence: C)* (8-11)

172. Third degree AV block or advanced second degree AV block (Mobitz II AV block or high degree AV block)
Asymptomatic
CRT not indicated

2008 DEVICE-BASED THERAPY GUIDELINES:

2.1.2 Recommendations for Acquired Atrioventricular Block in Adults

CLASS I

- Permanent pacemaker implantation is indicated for third-degree and advanced second-degree AV block at any anatomic level in awake, symptom-free patients in sinus rhythm, with documented periods of asystole greater than or equal to 3.0 seconds (12) or any escape rate less than 40 bpm, or with an escape rhythm that is below the AV node. *(Level of Evidence: C)* (3,13)
- Permanent pacemaker implantation is indicated for third-degree and advanced second-degree AV block at any anatomic level in awake, symptom-free patients with AF and bradycardia with 1 or more pauses of at least 5 seconds or longer. *(Level of Evidence: C)*
- Permanent pacemaker implantation is indicated for asymptomatic persistent third-degree AV block at any anatomic site with average awake ventricular rates of 40 bpm or faster if cardiomegaly or LV dysfunction is present or if the site of block is below the AV node. *(Level of Evidence: B)* (10,14)

CLASS IIa

- Permanent pacemaker implantation is reasonable for asymptomatic type II second-degree AV block with a narrow QRS. When type II second-degree AV block occurs with a wide QRS, including isolated right bundle-branch block, pacing becomes a Class I recommendation. (See Section 2.1.3, "Chronic Bifascicular Block.") *(Level of Evidence: B)* (10-11,15-16)
- Permanent pacemaker implantation is reasonable for persistent third-degree AV block with an escape rate greater than 40 bpm in asymptomatic adult patients without cardiomegaly. *(Level of Evidence: C)* (8-11,17-18)

173. Mobitz Type I AV block
Asymptomatic
CRT not indicated

2008 DEVICE-BASED THERAPY GUIDELINES:

2.1.2 Recommendations for Acquired Atrioventricular Block in Adults

CLASS III

- Permanent pacemaker implantation is not indicated for asymptomatic type I second-degree AV block at the supra-His (AV node) level or that which is not known to be intra- or infra-Hisian. *(Level of Evidence: C)* (19)

174. First degree AV block (PR <300 msec)
Asymptomatic

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2008 DEVICE-BASED THERAPY GUIDELINES:

2.1.2 Recommendations for Acquired Atrioventricular Block in Adults

CLASS III

- Permanent pacemaker implantation is not indicated for asymptomatic first-degree AV block. *(Level of Evidence: B)* (20) (See Section 2.1.3, "Chronic Bifascicular Block.")

175. First degree AV block (PR ≥300 msec)
Asymptomatic

2008 DEVICE-BASED THERAPY GUIDELINES:

2.1.2 Recommendations for Acquired Atrioventricular Block in Adults

CLASS III

- Permanent pacemaker implantation is not indicated for asymptomatic first-degree AV block. *(Level of Evidence: B)* (20) (See Section 2.1.3, "Chronic Bifascicular Block.")

Conduction System Abnormalities
Bundle Branch Block

176. Sinus rhythm with normal PR interval
LBBB
CRT not indicated

2008 DEVICE-BASED THERAPY GUIDELINES:

2.1.3 Recommendations for Permanent Pacing in Chronic Bifascicular Block

CLASS III

- Permanent pacemaker implantation is not indicated for fascicular block without AV block or symptoms. *(Level of Evidence: B)* (21-24)
- Permanent pacemaker implantation is not indicated for fascicular block with first-degree AV block without symptoms. *(Level of Evidence: B)* (21-24)

177. Sinus rhythm with first degree AV block
LBBB
CRT not indicated

2008 DEVICE-BASED THERAPY GUIDELINES:

2.1.3 Recommendations for Permanent Pacing in Chronic Bifascicular Block

CLASS III

- Permanent pacemaker implantation is not indicated for fascicular block without AV block or symptoms. *(Level of Evidence: B)* (21-24)
- Permanent pacemaker implantation is not indicated for fascicular block with first-degree AV block without symptoms. *(Level of Evidence: B)* (21-24)

178. Sinus rhythm with normal PR interval
Bifascicular block (RBBB/LAFB or RBBB/LPFB)
CRT not indicated

2008 DEVICE-BASED THERAPY GUIDELINES:

2.1.3 Recommendations for Permanent Pacing in Chronic Bifascicular Block

CLASS III

- Permanent pacemaker implantation is not indicated for fascicular block without AV block or symptoms. *(Level of Evidence: B)* (21-24)
- Permanent pacemaker implantation is not indicated for fascicular block with first-degree AV block without symptoms. *(Level of Evidence: B)* (21-24)

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179. Sinus rhythm with first degree AV block
Bifascicular block (RBBB/LAFB or RBBB /LPFB)
CRT not indicated

2008 DEVICE-BASED THERAPY GUIDELINES:

2.1.3 Recommendations for Permanent Pacing in Chronic Bifascicular Block

CLASS III

- Permanent pacemaker implantation is not indicated for fascicular block without AV block or symptoms. *(Level of Evidence: B)* (21-24)
- Permanent pacemaker implantation is not indicated for fascicular block with first-degree AV block without symptoms. *(Level of Evidence: B)* (21-24)

180. Alternating RBBB and LBBB
CRT not indicated

2008 DEVICE-BASED THERAPY GUIDELINES:

2.1.3 Recommendations for Permanent Pacing in Chronic Bifascicular Block

CLASS I

- Permanent pacemaker implantation is indicated for alternating bundle-branch block. *(Level of Evidence: C)* (25)

Conduction System Abnormalities
Acute MI or Ischemic Event

181. Transient AV block thought to be secondary to ischemia Status-post successful revascularization	Narrow QRS (<120 msec)	Chronic Wide QRS (≥120 msec)

2008 DEVICE-BASED THERAPY GUIDELINES:

2.1.4. Recommendations for Permanent Pacing After the Acute Phase of Myocardial Infarction

CLASS I

- Permanent ventricular pacing is indicated for transient advanced second- or third-degree infranodal AV block and associated bundle-branch block. If the site of block is uncertain, an electrophysiological study may be necessary. *(Level of Evidence: B)* (26-27)

CLASS III

- Permanent ventricular pacing is not indicated for transient AV block in the absence of intraventricular conduction defects. *(Level of Evidence: B)* (26)
- Permanent ventricular pacing is not indicated for transient AV block in the presence of isolated left anterior fascicular block. *(Level of Evidence: B)* (28)

182. Transient AV block thought to be secondary to ischemia Not amenable to revascularization	Narrow QRS (<120 msec)	Chronic Wide QRS (≥120 msec)

2008 DEVICE-BASED THERAPY GUIDELINES:

2.1.4. Recommendations for Permanent Pacing After the Acute Phase of Myocardial Infarction

CLASS I

- Permanent ventricular pacing is indicated for transient advanced second- or third-degree infranodal AV block and associated bundle-branch block. If the site of block is uncertain, an electrophysiological study may be necessary. *(Level of Evidence: B)* (26-27)

CLASS III

- Permanent ventricular pacing is not indicated for transient AV block in the absence of intraventricular conduction defects. *(Level of Evidence: B)* (26)
- Permanent ventricular pacing is not indicated for transient AV block in the presence of isolated left anterior fascicular block. *(Level of Evidence: B)* (28)

Conduction System Abnormalities
Cardiac Valve Surgery

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183. Transient AV block Narrow QRS (<120 msec)
Not addressed in guidelines
184. New LBBB and first degree AV block
Not addressed in guidelines

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Table 5.2 No Conduction Abnormalities

Meets Criteria for ICD (Narrow QRS <120 msec)
185. Sinus rhythm with normal PR interval Asymptomatic
Not addressed in guidelines

References: None

Table 5.3 Tachyarrhythmias

Atrial Arrhythmias or "SVT" and No Standard Pacing Indications
186. Paroxysmal atrial arrhythmias
Not addressed in guidelines
187. Underlying structural heart disease (e.g., ischemic or nonischemic CM) No known paroxysmal atrial arrhythmias/SVT
Not addressed in guidelines
188. Structurally normal heart No known paroxysmal atrial arrhythmias/SVT
Not addressed in guidelines
189. Long-standing persistent or permanent atrial fibrillation or atrial flutter No plans for cardioversion or rhythm control
2004 STEMI GUIDELINES: **7.7.3.2.3. Pacing Mode Selection in STEMI Patients** Class IIa • It is reasonable to implant a permanent dual-chamber pacing system in STEMI patients who need permanent pacing and are in sinus rhythm. It is reasonable that patients in permanent AF or atrial flutter receive a single-chamber ventricular device. (*Level of Evidence: C*)
Slow Ventricular Arrhythmias Known
190. Active patient Known "slow VT" that overlaps with sinus tachycardia rate
Not addressed in guidelines

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Table 5.4 Other Disorders

Genetic Disorders
191. Congenital Long QT Syndrome ICD for secondary prevention
2008 DEVICE-BASED THERAPY GUIDELINES: **2.3.2 Recommendations for Pacing to Prevent Trachycardia** Class I • Permanent pacing is indicated for sustained pause-dependent VT, with or without QT prolongation (*Level of Evidence: C*) Class IIa • Permanent pacing is reasonable for high-risk patients with congenital long-QT syndrome (*Level of Evidence: C*)
192. Congenital Long QT Syndrome ICD for primary prevention
2008 DEVICE-BASED THERAPY GUIDELINES: **2.3.2 Recommendations for Pacing to Prevent Trachycardia** Class I • Permanent pacing is indicated for sustained pause-dependent VT, with or without QT prolongation (*Level of Evidence: C*) Class IIa • Permanent pacing is reasonable for high-risk patients with congenital long-QT syndrome (*Level of Evidence: C*)
193. HCM Narrow QRS (<120 msec) No standard bradycardia pacing indications
2011 HYPERTROPHIC CARDIOMYOPATHY GUIDELINES: **6.2.2.6 Pacing** Class IIb • Permanent pacing may be considered in medically refractory symptomatic patients with obstructive HCM who are suboptimal candidates for septal reduction therapy. *(Level of Evidence: B)*
194. HCM Wide QRS (≥120 msec) No standard bradycardia pacing indications

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2011 HYPERTROPHIC CARDIOMYOPATHY GUIDELINES:

6.2.2.6 Pacing

Class IIb

- Permanent pacing may be considered in medically refractory symptomatic patients with obstructive HCM who are suboptimal candidates for septal reduction therapy. *(Level of Evidence: B)*

References:

1. Epstein AE, DiMarco JP, Ellenbogen KA, Estes NAM III, Freedman RA, Gettes LS, Gillinov AM, Gregoratos G, Hammill SC, Hayes DL, Hlatky MA, Newby LK, Page RL, Schoenfeld MH, Silka MJ, Stevenson LW, Sweeney MO. ACC/AHA/HRS 2008 guidelines for device-based therapy of cardiac rhythm abnormalities: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to Revise the ACC/AHA/NASPE 2002 Guideline Update for Implantation of Cardiac Pacemakers and Antiarrhythmia Devices). J Am Coll Cardiol 2008;51:e1–62.
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Section 6. CRT – No Prior Implant

The ACC/AHA/HRS 2008 Guidelines for device-based therapy designate a Class I indication for CRT implantation to include patients who have LVEF ≤35%, a QRS duration ≥120 msec, and sinus rhythm with NYHA functional Class III or ambulatory Class IV heart failure symptoms despite optimal medical therapy. Newer information has been obtained from the MADIT-CRT trial that demonstrates a benefit of CRT therapy for patients with LVEF ≤30%, QRS ≥130 msec and NYHA Class I or II heart failure, though the majority of patients had baseline LBBB and a main exclusion criteria was atrial fibrillation within 1 month of enrollment. It is anticipated that the results of this trial will soon be incorporated into the updated Guidelines for device-based therapy. A pre-specified subgroup analysis from this trial also demonstrated that patients with a QRS ≥150 msec derived benefit from CRT, while those with QRS <150 msec did not demonstrate benefit with respect to the endpoint of risk of death or heart failure events, with two treatment interactions identified in this analysis (i.e., QRS duration and sex). It should be noted that this trial included patients with ischemic cardiomyopathy (NYHA class I or II) or nonischemic cardiomyopathy (NYHA class II only), and results of this trial cannot necessarily be extrapolated to nonischemic patients with NYHA class I heart failure.

A variety of different QRS durations have been utilized for eligibility criteria in different studies and, therefore, for the purpose of this AUC document, the QRS duration has been classified as follows: (a) QRS <120 msec (normal duration); (b) QRS 120-150 msec; (c) 120-149 msec; (d) ≥150 msec; For the purpose of Section 4.0 in this AUC document, it is assumed that the QRS duration of 130 msec and the results of this trial will apply to the second category of QRS 120-150 msec, even though patients with a QRS duration of 120-129 msec were not specifically included in this trial.

Table 6.1 Ischemic Cardiomyopathy

LVEF ≤30% NYHA Class	I	II	III-amb IV
195. QRS <120 msec Sinus rhythm			
DRAFT 2012 DEVICE-BASED THERAPY UPDATE: **Recommendations for CRT in Patients with Systolic Heart Failure** Class III • CRT is not recommended for patients with NYHA functional class I or II symptoms and non-LBBB with QRS less than 150 msec (4-6). *(Level of Evidence: B)*			
196. QRS 120-149 msec LBBB Sinus rhythm			
DRAFT 2012 DEVICE-BASED THERAPY UPDATE: **Recommendations for CRT in Patients with Systolic Heart Failure** Class IIa • CRT can be useful for patients who have LVEF less than or equal to 35%, sinus rhythm, LBBB with a QRS duration 120 to 149 msec, and NYHA functional class II, III or ambulatory IV symptoms on GDMT. (4-5,7-10) *(Level of Evidence: A)*			
197. QRS ≥150 msec LBBB Sinus rhythm			
DRAFT 2012 DEVICE-BASED THERAPY UPDATE: **Recommendations for CRT in Patients with Systolic Heart Failure** Class I • CRT is indicated for patients who have LVEF less than or equal to 35%, sinus rhythm, LBBB with a QRS duration greater than or equal to 150 msec, and NYHA functional class II, III, or ambulatory IV symptoms on GDMT (4-5,7-11). *(Level of Evidence: A)* Class IIb • CRT may be considered for patients who have LVEF less than 30%, ischemic etiology of heart failure, sinus rhythm, LBBB			

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with a QRS duration of greater than or equal to 150 msec, and NYHA functional class I symptoms on GDMT (4-5). *(Level of Evidence: B)*

198. QRS 120-149 msec
Non-LBBB
Sinus rhythm

DRAFT 2012 DEVICE-BASED THERAPY UPDATE:

Recommendations for CRT in Patients with Systolic Heart Failure

Class IIb

- CRT may be considered for patients who have LVEF less than or equal to 35%, sinus rhythm, a non-LBBB pattern with QRS duration 120 to 149 msec, and NYHA functional class III/ambulatory class IV on GDMT (4,6). *(Level of Evidence: B)*

Class III

- CRT is not recommended for patients with NYHA functional class I or II symptoms and non-LBBB with QRS less than 150 msec (4-6). *(Level of Evidence: B)*

199. QRS ≥150 msec
Non-LBBB
Sinus rhythm

DRAFT 2012 DEVICE-BASED THERAPY UPDATE:

Recommendations for CRT in Patients with Systolic Heart Failure

Class IIa

- CRT can be useful for patients who have LVEF less than or equal to 35%, sinus rhythm, a non-LBBB pattern with a QRS greater than or equal to 150 msec, and NYHA functional class III/ambulatory class IV symptoms on GDMT (4, 7-9). *(Level of Evidence: A)*

Class IIb

- CRT may be considered for patients who have LVEF less than or equal to 35%, sinus rhythm, a non-LBBB with a QRS duration greater than or equal to 150 msec, and NYHA functional class II symptoms on GDMT (4-5). *(Level of Evidence: B)*

2008 DEVICE-BASED THERAPY GUIDELINES:

2.4.1 Recommendations for Cardiac Resynchronization Therapy in Patients With Severe Systolic Heart Failure

CLASS I

- For patients who have LVEF less than or equal to 35%, a QRS duration greater than or equal to 0.12 seconds, and sinus rhythm, CRT with or without an ICD is indicated for the treatment of NYHA functional Class III or ambulatory Class IV heart failure symptoms with optimal recommended medical therapy. (*Level of Evidence: A*) (7-9,11)

CLASS IIa

- For patients who have LVEF less than or equal to 35%, a QRS duration greater than or equal to 0.12 seconds, and AF, CRT with or without an ICD is reasonable for the treatment of NYHA functional Class III or ambulatory Class IV heart failure symptoms on optimal recommended medical therapy. (*Level of Evidence: B*) (11-12)

Class III

- CRT is not indicated for asymptomatic patients with reduced LVEF in the absence of other indications for pacing (*Level of Evidence: B*).

2009 HEART FAILURE GUIDELINES:

4.3.1. Patients With Reduced Left Ventricular Ejection Fraction

CLASS I

- Patients with LVEF of less than or equal to 35%, sinus rhythm, and NYHA functional class III ambulatory class IV symptoms despite recommended optimal medical therapy and who have cardiac dyssynchrony, which is currently defined as a QRS duration greater than or equal to 0.12 seconds, should receive cardiac resynchronization therapy, with or without an ICD, unless contraindicated (6-7,13-26). (*Level of Evidence: A*)

2006 VENTRICULAR ARRHYTHMIA GUIDELINES:

10. Heart Failure

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Class IIa

- 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*)
- 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 y. (*Level of Evidence: B*)

LVEF 31-35% NYHA Class	I	II	III-amb IV
200. QRS <120 msec Sinus rhythm			

DRAFT 2012 DEVICE-BASED THERAPY UPDATE:

Recommendations for CRT in Patients with Systolic Heart Failure

Class III

- CRT is not recommended for patients with NYHA functional class I or II symptoms and non-LBBB with QRS less than 150 msec (4-6). *(Level of Evidence: B)*

201. QRS 120-149 msec LBBB Sinus rhythm

DRAFT 2012 DEVICE-BASED THERAPY UPDATE:

Recommendations for CRT in Patients with Systolic Heart Failure

Class IIa

- CRT can be useful for patients who have LVEF less than or equal to 35%, sinus rhythm, LBBB with a QRS duration 120 to 149 msec, and NYHA functional class II, III or ambulatory IV symptoms on GDMT. (4-5,7-10) *(Level of Evidence: A)*

202. QRS ≥150 msec LBBB Sinus rhythm

DRAFT 2012 DEVICE-BASED THERAPY UPDATE:

Recommendations for CRT in Patients with Systolic Heart Failure

Class I

- CRT is indicated for patients who have LVEF less than or equal to 35%, sinus rhythm, LBBB with a QRS duration greater than or equal to 150 msec, and NYHA functional class II, III, or ambulatory IV symptoms on GDMT (4-5,7-11). *(Level of Evidence: A)*

203. QRS 120-149 msec Non-LBBB Sinus rhythm

DRAFT 2012 DEVICE-BASED THERAPY UPDATE:

Recommendations for CRT in Patients with Systolic Heart Failure

Class IIb

- CRT may be considered for patients who have LVEF less than or equal to 35%, sinus rhythm, a non-LBBB pattern with QRS duration 120 to 149 msec, and NYHA functional class III/ambulatory class IV on GDMT (4,6). *(Level of Evidence: B)*

Class III

- CRT is not recommended for patients with NYHA functional class I or II symptoms and non-LBBB with QRS less than 150 msec (4-6). *(Level of Evidence: B)*

204. QRS ≥150 msec

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Non-LBBB
Sinus rhythm

DRAFT 2012 DEVICE-BASED THERAPY UPDATE:

Recommendations for CRT in Patients with Systolic Heart Failure

Class IIa

- CRT can be useful for patients who have LVEF less than or equal to 35%, sinus rhythm, a non-LBBB pattern with a QRS greater than or equal to 150 msec, and NYHA functional class III/ambulatory class IV symptoms on GDMT (4, 7-9). *(Level of Evidence: A)*

Class IIb

- CRT may be considered for patients who have LVEF less than or equal to 35%, sinus rhythm, a non-LBBB with a QRS duration greater than or equal to 150 msec, and NYHA functional class II symptoms on GDMT (4-5). *(Level of Evidence: B)*

2008 DEVICE-BASED THERAPY GUIDELINES:

2.4.1 Recommendations for Cardiac Resynchronization Therapy in Patients With Severe Systolic Heart Failure

CLASS I

- For patients who have LVEF less than or equal to 35%, a QRS duration greater than or equal to 0.12 seconds, and sinus rhythm, CRT with or without an ICD is indicated for the treatment of NYHA functional Class III or ambulatory Class IV heart failure symptoms with optimal recommended medical therapy. (*Level of Evidence: A*) (7-9,11)

CLASS IIa

- For patients who have LVEF less than or equal to 35%, a QRS duration greater than or equal to 0.12 seconds, and AF, CRT with or without an ICD is reasonable for the treatment of NYHA functional Class III or ambulatory Class IV heart failure symptoms on optimal recommended medical therapy. (*Level of Evidence: B*) (11-12)

2009 HEART FAILURE GUIDELINES:

4.3.1. Patients With Reduced Left Ventricular Ejection Fraction

CLASS I

- Patients with LVEF of less than or equal to 35%, sinus rhythm, and NYHA functional class III ambulatory class IV symptoms despite recommended optimal medical therapy and who have cardiac dyssynchrony, which is currently defined as a QRS duration greater than or equal to 0.12 seconds, should receive cardiac resynchronization therapy, with or without an ICD, unless contraindicated (6-7,13-26). (*Level of Evidence: A*)

2006 VENTRICULAR ARRHYTHMIA GUIDELINES:

10. Heart Failure

Class IIa

- 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*)
- 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 y. (*Level of Evidence: B*)

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Table 6.2 Nonischemic Cardiomyopathy

LVEF ≤30% NYHA Class	I	II	III-amb IV
205. QRS <120 msec Sinus rhythm			
DRAFT 2012 DEVICE-BASED THERAPY UPDATE: **Recommendations for CRT in Patients with Systolic Heart Failure** Class III • CRT is not recommended for patients with NYHA functional class I or II symptoms and non-LBBB with QRS less than 150 msec (4-6). *(Level of Evidence: B)*			
206. QRS 120-149 msec LBBB Sinus rhythm			
DRAFT 2012 DEVICE-BASED THERAPY UPDATE: **Recommendations for CRT in Patients with Systolic Heart Failure** Class IIa • CRT can be useful for patients who have LVEF less than or equal to 35%, sinus rhythm, LBBB with a QRS duration 120 to 149 msec, and NYHA functional class II, III or ambulatory IV symptoms on GDMT. (4-5,7-10) *(Level of Evidence: A)*			
207. QRS ≥150 msec LBBB Sinus rhythm			
DRAFT 2012 DEVICE-BASED THERAPY UPDATE: **Recommendations for CRT in Patients with Systolic Heart Failure** Class I • CRT is indicated for patients who have LVEF less than or equal to 35%, sinus rhythm, LBBB with a QRS duration greater than or equal to 150 msec, and NYHA functional class II, III, or ambulatory IV symptoms on GDMT (4-5,7-11). *(Level of Evidence: A)* Class IIb • CRT may be considered for patients who have LVEF less than 30%, ischemic etiology of heart failure, sinus rhythm, LBBB with a QRS duration of greater than or equal to 150 msec, and NYHA functional class I symptoms on GDMT (4-5). *(Level of Evidence: B)*			
208. QRS 120-149 msec Non-LBBB Sinus rhythm			
DRAFT 2012 DEVICE-BASED THERAPY UPDATE: **Recommendations for CRT in Patients with Systolic Heart Failure** Class IIb • CRT may be considered for patients who have LVEF less than or equal to 35%, sinus rhythm, a non-LBBB pattern with QRS duration 120 to 149 msec, and NYHA functional class III/ambulatory class IV on GDMT (4,6). *(Level of Evidence: B)* Class III • CRT is not recommended for patients with NYHA functional class I or II symptoms and non-LBBB with QRS less than 150 msec (4-6). *(Level of Evidence: B)*			
209. QRS ≥150 msec Non-LBBB Sinus rhythm			

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DRAFT 2012 DEVICE-BASED THERAPY UPDATE:

Recommendations for CRT in Patients with Systolic Heart Failure

Class IIa

- CRT can be useful for patients who have LVEF less than or equal to 35%, sinus rhythm, a non-LBBB pattern with a QRS greater than or equal to 150 msec, and NYHA functional class III/ambulatory class IV symptoms on GDMT (4, 7-9). *(Level of Evidence: A)*

Class IIb

- CRT may be considered for patients who have LVEF less than or equal to 35%, sinus rhythm, a non-LBBB with a QRS duration greater than or equal to 150 msec, and NYHA functional class II symptoms on GDMT (4-5). *(Level of Evidence: B)*

2008 DEVICE-BASED THERAPY GUIDELINES:

2.4.1 Recommendations for Cardiac Resynchronization Therapy in Patients With Severe Systolic Heart Failure

CLASS I

- For patients who have LVEF less than or equal to 35%, a QRS duration greater than or equal to 0.12 seconds, and sinus rhythm, CRT with or without an ICD is indicated for the treatment of NYHA functional Class III or ambulatory Class IV heart failure symptoms with optimal recommended medical therapy. (*Level of Evidence: A*) (7-9,11)

CLASS IIa

- For patients who have LVEF less than or equal to 35%, a QRS duration greater than or equal to 0.12 seconds, and AF, CRT with or without an ICD is reasonable for the treatment of NYHA functional Class III or ambulatory Class IV heart failure symptoms on optimal recommended medical therapy. (*Level of Evidence: B*) (11-12)

2009 HEART FAILURE GUIDELINES:

4.3.1. Patients With Reduced Left Ventricular Ejection Fraction

CLASS I

- Patients with LVEF of less than or equal to 35%, sinus rhythm, and NYHA functional class III ambulatory class IV symptoms despite recommended optimal medical therapy and who have cardiac dyssynchrony, which is currently defined as a QRS duration greater than or equal to 0.12 seconds, should receive cardiac resynchronization therapy, with or without an ICD, unless contraindicated (6-7,13-26). (*Level of Evidence: A*)

2006 VENTRICULAR ARRHYTHMIA GUIDELINES:

10. Heart Failure

Class IIa

- 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*)
- 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 y. (*Level of Evidence: B*)

LVEF 31-35% NYHA Class	I	II	III-amb IV
210. QRS <120 msec Sinus rhythm			

DRAFT 2012 DEVICE-BASED THERAPY UPDATE:

Recommendations for CRT in Patients with Systolic Heart Failure

Class III

- CRT is not recommended for patients with NYHA functional class I or II symptoms and non-LBBB with QRS less than 150 msec (4-6). *(Level of Evidence: B)*

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211. QRS 120-149 msec
LBBB
Sinus rhythm

DRAFT 2012 DEVICE-BASED THERAPY UPDATE:

Recommendations for CRT in Patients with Systolic Heart Failure

Class IIa

- CRT can be useful for patients who have LVEF less than or equal to 35%, sinus rhythm, LBBB with a QRS duration 120 to 149 msec, and NYHA functional class II, III or ambulatory IV symptoms on GDMT. (4-5,7-10) *(Level of Evidence: A)*

212. QRS ≥150 msec
LBBB
Sinus rhythm

DRAFT 2012 DEVICE-BASED THERAPY UPDATE:

Recommendations for CRT in Patients with Systolic Heart Failure

Class I

- CRT is indicated for patients who have LVEF less than or equal to 35%, sinus rhythm, LBBB with a QRS duration greater than or equal to 150 msec, and NYHA functional class II, III, or ambulatory IV symptoms on GDMT (4-5,7-11). *(Level of Evidence: A)*

213. QRS 120-149 msec
Non-LBBB
Sinus rhythm

DRAFT 2012 DEVICE-BASED THERAPY UPDATE:

Recommendations for CRT in Patients with Systolic Heart Failure

Class IIb

- CRT may be considered for patients who have LVEF less than or equal to 35%, sinus rhythm, a non-LBBB pattern with QRS duration 120 to 149 msec, and NYHA functional class III/ambulatory class IV on GDMT (4,6). *(Level of Evidence: B)*

Class III

- CRT is not recommended for patients with NYHA functional class I or II symptoms and non-LBBB with QRS less than 150 msec (4-6). *(Level of Evidence: B)*

214. QRS ≥150 msec
Non-LBBB
Sinus rhythm

DRAFT 2012 DEVICE-BASED THERAPY UPDATE:

Recommendations for CRT in Patients with Systolic Heart Failure

Class IIa

- CRT can be useful for patients who have LVEF less than or equal to 35%, sinus rhythm, a non-LBBB pattern with a QRS greater than or equal to 150 msec, and NYHA functional class III/ambulatory class IV symptoms on GDMT (4, 7-9). *(Level of Evidence: A)*

Class IIb

- CRT may be considered for patients who have LVEF less than or equal to 35%, sinus rhythm, a non-LBBB with a QRS duration greater than or equal to 150 msec, and NYHA functional class II symptoms on GDMT (4-5). *(Level of Evidence: B)*

2008 DEVICE-BASED THERAPY GUIDELINES:

2.4.1 Recommendations for Cardiac Resynchronization Therapy in Patients With Severe Systolic Heart Failure

CLASS I

- For patients who have LVEF less than or equal to 35%, a QRS duration greater than or equal to 0.12 seconds, and sinus rhythm, CRT with or without an ICD is indicated for the treatment of NYHA functional Class III or ambulatory Class IV heart failure symptoms with optimal recommended medical therapy. (*Level of Evidence: A*) (7-9,11)

CLASS IIa

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- For patients who have LVEF less than or equal to 35%, a QRS duration greater than or equal to 0.12 seconds, and AF, CRT with or without an ICD is reasonable for the treatment of NYHA functional Class III or ambulatory Class IV heart failure symptoms on optimal recommended medical therapy. (*Level of Evidence: B*) (11-12)

2009 HEART FAILURE GUIDELINES:

4.3.1. Patients With Reduced Left Ventricular Ejection Fraction

CLASS I

- Patients with LVEF of less than or equal to 35%, sinus rhythm, and NYHA functional class III ambulatory class IV symptoms despite recommended optimal medical therapy and who have cardiac dyssynchrony, which is currently defined as a QRS duration greater than or equal to 0.12 seconds, should receive cardiac resynchronization therapy, with or without an ICD, unless contraindicated (6-7,13-26). (*Level of Evidence: A*)

2006 VENTRICULAR ARRHYTHMIA GUIDELINES:

10. Heart Failure

Class IIa

- 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*)
- 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 y. (*Level of Evidence: B*)

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32. *Van Bommel RJ, Bax JJ, Abraham WT, et al. Characteristics of heart failure patients associated with good and poor response to cardiac resynchronization therapy: a PROSPECT sub-analysis. Eur Heart J. 2009; 30: 2470-7.*
33. *Al-Majed NS, McAlister FA, Bakal JA, et al. Meta-analysis: Cardiac resynchronization therapy for patients with less symptomatic heart failure. Ann Intern Med. 2011; 154: 401-12.*
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Table 6.3.1 LVEF >35% of Any Etiology (ICD Indicated)

NYHA Class	I-II	III-amb IV
215. QRS <120 msec Sinus rhythm		
Not addressed in guidelines		
216. QRS 120-149 msec LBBB Sinus rhythm		
Not addressed in guidelines		
217. QRS ≥150 msec LBBB Sinus rhythm		
Not addressed in guidelines		

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218. QRS 120-149 msec Non-LBBB Sinus rhythm
Not addressed in guidelines
219. QRS ≥150 msec Non-LBBB Sinus rhythm
Not addressed in guidelines

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Table 6.3.2 LVEF ≤35% of Any Etiology

NYHA Class IV On Intravenous Inotropic Support
220. QRS 120-149 msec LBBB
<u>DRAFT 2012 DEVICE-BASED THERAPY UPDATE:</u> **Recommendations for CRT in Patients with Systolic Heart Failure** Class IIa • CRT can be useful for patients who have LVEF less than or equal to 35%, sinus rhythm, LBBB with a QRS duration 120 to 149 msec, and NYHA functional class II, III or ambulatory IV symptoms on GDMT (3-9). (*Level of Evidence: A)*
221. QRS ≥150 msec LBBB
<u>DRAFT 2012 DEVICE-BASED THERAPY UPDATE:</u> **Recommendations for CRT in Patients with Systolic Heart Failure** Class I • CRT is indicated for patients who have LVEF less than or equal to 35%, sinus rhythm, LBBB with a QRS duration greater than or equal to 150 msec, and NYHA functional class II, III, or ambulatory IV symptoms on GDMT (3-9). *(Level of Evidence: A)*
222. QRS 120-149 msec Non-LBBB
<u>DRAFT 2012 DEVICE-BASED THERAPY UPDATE:</u> **Recommendations for CRT in Patients with Systolic Heart Failure** Class IIb • CRT may be considered for patients who have LVEF less than or equal to 35%, sinus rhythm, a non-LBBB pattern with QRS duration 120 to 149 msec, and NYHA functional class III/ambulatory class IV on GDMT (3, 10). *(Level of Evidence: B)*
223. QRS ≥150 msec Non-LBBB

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DRAFT 2012 DEVICE-BASED THERAPY UPDATE:

Recommendations for CRT in Patients with Systolic Heart Failure

Class IIa

- CRT can be useful for patients who have LVEF less than or equal to 35%, sinus rhythm, a non-LBBB pattern with a QRS greater than or equal to 150 msec, and NYHA functional class III/ambulatory class IV symptoms on GDMT (3, 5-7). *(Level of Evidence: A)*

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Table 6.4 Preexisting or Anticipated RV Pacing With a Clinical Indication for ICD or Pacemaker Implantation

Intrinsic Narrow QRS, LVEF ≤35%	NYHA Class	I-II	III-amb IV
224. RV pacing anticipated ≤40%			
Not addressed in guidelines			
225. RV pacing anticipated >40%			

DRAFT 2012 DEVICE-BASED THERAPY UPDATE:

Recommendations for CRT in Patients with Systolic Heart Failure

Class IIa

- CRT can be useful for patients on GDMT who have LVEF less than or equal to 35%, and are undergoing device placement with anticipated requirement for significant ventricular pacing (2-5). *(Level of Evidence: C)*

2008 DEVICE-BASED THERAPY GUIDELINES:

2.4.1 Recommendations for Cardiac Resynchronization Therapy in Patients With Severe Systolic Heart Failure

CLASS IIa

- For patients with LVEF less than or equal to 35% with NYHA functional Class III or ambulatory Class IV symptoms who are receiving optimal recommended medical therapy and who have frequent dependence on ventricular pacing, CRT is reasonable (6). (*Level of Evidence: C*)

CLASS IIb

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- For patients with LVEF less than or equal to 35% with NYHA functional Class I or II symptoms who are receiving optimal recommended medical therapy and who are undergoing implantation of a permanent pacemaker and/or ICD with anticipated frequent ventricular pacing, CRT may be considered (6). (*Level of Evidence: C*)

2009 HEART FAILURE GUIDELINES:

4.3.1. Patients With Reduced Left Ventricular Ejection Fraction

CLASS IIa

- For patients with LVEF of less than or equal to 35% with NYHA functional class III or ambulatory class IV symptoms who are receiving optimal recommended medical therapy and who have frequent dependence on ventricular pacing, CRT is reasonable (6). (*Level of Evidence: C*)

Intrinsic Narrow QRS, LVEF >35%	NYHA Class	I-II	III-amb IV
226. RV pacing anticipated ≤40%			
Not addressed in guidelines			
227. RV pacing anticipated >40%			
Not addressed in guidelines			

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1. Epstein AE, DiMarco JP, Ellenbogen KA, Estes NAM III, Freedman RA, Gettes LS, Gillinov AM, Gregoratos G, Hammill SC, Hayes DL, Hlatky MA, Newby LK, Page RL, Schoenfeld MH, Silka MJ, Stevenson LW, Sweeney MO. ACC/AHA/HRS 2008 guidelines for device-based therapy of cardiac rhythm abnormalities: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to Revise the ACC/AHA/NASPE 2002 Guideline Update for Implantation of Cardiac Pacemakers and Antiarrhythmia Devices). J Am Coll Cardiol 2008;51:e1–62.
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Table 6.5 Refractory Class III/IV CHF <3 Months Post Revascularization and/or ≤40 Days Post MI

No Other Indication for Ventricular Pacing LVEF ≤35%
228. QRS 120-149 msec LBBB

DRAFT 2012 DEVICE-BASED THERAPY UPDATE:

Recommendations for CRT in Patients with Systolic Heart Failure

Class IIa

- CRT can be useful for patients who have LVEF less than or equal to 35%, sinus rhythm, LBBB with a QRS duration 120 to 149 msec, and NYHA functional class II, III or ambulatory IV symptoms on GDMT (4-9). *(Level of Evidence: A)*

2008 DEVICE-BASED THERAPY GUIDELINES:

2.4.1 Recommendations for Cardiac Resynchronization Therapy in Patients With Severe Systolic Heart Failure

CLASS IIa

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- For patients who have LVEF less than or equal to 35%, a QRS duration greater than or equal to 0.12 seconds, and AF, CRT with or without an ICD is reasonable for the treatment of NYHA functional Class III or ambulatory Class IV heart failure symptoms on optimal recommended medical therapy. (*Level of Evidence: B*) (10-11)
- For patients with LVEF less than or equal to 35% with NYHA functional Class III or ambulatory Class IV symptoms who are receiving optimal recommended medical therapy and who have frequent dependence on ventricular pacing, CRT is reasonable. (*Level of Evidence: C*) (10)

CLASS IIb

- For patients with LVEF less than or equal to 35% with NYHA functional Class I or II symptoms who are receiving optimal recommended medical therapy and who are undergoing implantation of a permanent pacemaker and/or ICD with anticipated frequent ventricular pacing, CRT may be considered. (*Level of Evidence: C*) (10)

2009 HEART FAILURE GUIDELINES:

4.3.1. Patients With Reduced Left Ventricular Ejection Fraction

CLASS I

- Patients with LVEF of less than or equal to 35%, sinus rhythm, and NYHA functional class III ambulatory class IV symptoms despite recommended optimal medical therapy and who have cardiac dyssynchrony, which is currently defined as a QRS duration greater than or equal to 0.12 seconds, should receive cardiac resynchronization therapy, with or without an ICD, unless contraindicated (4-6,12-24). (*Level of Evidence: A*)

CLASS IIa

- For patients with LVEF of less than or equal to 35% with NYHA functional class III or ambulatory class IV symptoms who are receiving optimal recommended medical therapy and who have frequent dependence on ventricular pacing, CRT is reasonable (10). (*Level of Evidence: C*)

2004 STEMI GUIDELINES:

7.7.3.2.3. Pacing Mode Selection in STEMI Patients

Class IIa

- It is reasonable to evaluate all patients who have an indication for permanent pacing after STEMI for biventricular pacing (cardiac resynchronization therapy). (*Level of Evidence: C*)

229. QRS ≥150 msec
LBBB

DRAFT 2012 DEVICE-BASED THERAPY UPDATE:

Recommendations for CRT in Patients with Systolic Heart Failure

Class I

- CRT is indicated for patients who have LVEF less than or equal to 35%, sinus rhythm, LBBB with a QRS duration greater than or equal to 150 msec, and NYHA functional class II, III, or ambulatory IV symptoms on GDMT (4-8,10). *(Level of Evidence: A)*

Class IIb

- CRT may be considered for patients who have LVEF less than 30%, ischemic etiology of heart failure, sinus rhythm, LBBB with a QRS duration of greater than or equal to 150 msec, and NYHA functional class I symptoms on GDMT (7-8). *(Level of Evidence: B)*

2008 DEVICE-BASED THERAPY GUIDELINES:

2.4.1 Recommendations for Cardiac Resynchronization Therapy in Patients With Severe Systolic Heart Failure

CLASS IIa

- For patients who have LVEF less than or equal to 35%, a QRS duration greater than or equal to 0.12 seconds, and AF, CRT with or without an ICD is reasonable for the treatment of NYHA functional Class III or ambulatory Class IV heart failure symptoms on optimal recommended medical therapy. (*Level of Evidence: B*) (10-11)
- For patients with LVEF less than or equal to 35% with NYHA functional Class III or ambulatory Class IV symptoms who are receiving optimal recommended medical therapy and who have frequent dependence on ventricular pacing, CRT is

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reasonable. (*Level of Evidence: C*) (10)

CLASS IIb

- For patients with LVEF less than or equal to 35% with NYHA functional Class I or II symptoms who are receiving optimal recommended medical therapy and who are undergoing implantation of a permanent pacemaker and/or ICD with anticipated frequent ventricular pacing, CRT may be considered. (*Level of Evidence: C*) (10)

2009 HEART FAILURE GUIDELINES:

4.3.1. Patients With Reduced Left Ventricular Ejection Fraction

CLASS I

- Patients with LVEF of less than or equal to 35%, sinus rhythm, and NYHA functional class III ambulatory class IV symptoms despite recommended optimal medical therapy and who have cardiac dyssynchrony, which is currently defined as a QRS duration greater than or equal to 0.12 seconds, should receive cardiac resynchronization therapy, with or without an ICD, unless contraindicated (4-6,12-24). (*Level of Evidence: A*)

CLASS IIa

- For patients with LVEF of less than or equal to 35% with NYHA functional class III or ambulatory class IV symptoms who are receiving optimal recommended medical therapy and who have frequent dependence on ventricular pacing, CRT is reasonable (10). (*Level of Evidence: C*)

2004 STEMI GUIDELINES:

7.7.3.2.3. Pacing Mode Selection in STEMI Patients

Class IIa

- It is reasonable to evaluate all patients who have an indication for permanent pacing after STEMI for biventricular pacing (cardiac resynchronization therapy). (*Level of Evidence: C*)

230. QRS 120-149 msec
Non-LBBB

DRAFT 2012 DEVICE-BASED THERAPY UPDATE:

Recommendations for CRT in Patients with Systolic Heart Failure

Class IIa

- CRT may be considered for patients who have LVEF less than or equal to 35%, sinus rhythm, a non-LBBB pattern with QRS duration 120 to 149 msec, and NYHA functional class III/ambulatory class IV on GDMT (7,25). *(Level of Evidence: B)*

Class III

- CRT is not recommended for patients with NYHA functional class I or II symptoms and non-LBBB with QRS less than 150 msec (7-8,25). *(Level of Evidence: B)*

2008 DEVICE-BASED THERAPY GUIDELINES:

2.4.1 Recommendations for Cardiac Resynchronization Therapy in Patients With Severe Systolic Heart Failure

CLASS IIa

- For patients who have LVEF less than or equal to 35%, a QRS duration greater than or equal to 0.12 seconds, and AF, CRT with or without an ICD is reasonable for the treatment of NYHA functional Class III or ambulatory Class IV heart failure symptoms on optimal recommended medical therapy. (*Level of Evidence: B*) (10-11)
- For patients with LVEF less than or equal to 35% with NYHA functional Class III or ambulatory Class IV symptoms who are receiving optimal recommended medical therapy and who have frequent dependence on ventricular pacing, CRT is reasonable. (*Level of Evidence: C*) (10)

CLASS IIb

- For patients with LVEF less than or equal to 35% with NYHA functional Class I or II symptoms who are receiving optimal recommended medical therapy and who are undergoing implantation of a permanent pacemaker and/or ICD with anticipated frequent ventricular pacing, CRT may be considered. (*Level of Evidence: C*) (10)

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2009 HEART FAILURE GUIDELINES:

4.3.1. Patients With Reduced Left Ventricular Ejection Fraction

CLASS I

- Patients with LVEF of less than or equal to 35%, sinus rhythm, and NYHA functional class III ambulatory class IV symptoms despite recommended optimal medical therapy and who have cardiac dyssynchrony, which is currently defined as a QRS duration greater than or equal to 0.12 seconds, should receive cardiac resynchronization therapy, with or without an ICD, unless contraindicated (4-6,12-24). (*Level of Evidence: A*)

CLASS IIa

- For patients with LVEF of less than or equal to 35% with NYHA functional class III or ambulatory class IV symptoms who are receiving optimal recommended medical therapy and who have frequent dependence on ventricular pacing, CRT is reasonable (10). (*Level of Evidence: C*)

2004 STEMI GUIDELINES:

7.7.3.2.3. Pacing Mode Selection in STEMI Patients

Class IIa

- It is reasonable to evaluate all patients who have an indication for permanent pacing after STEMI for biventricular pacing (cardiac resynchronization therapy). (*Level of Evidence: C*)

231. QRS ≥150 msec
Non-LBBB

DRAFT 2012 DEVICE-BASED THERAPY UPDATE:

Recommendations for CRT in Patients with Systolic Heart Failure

Class IIa

- CRT can be useful for patients who have LVEF less than or equal to 35%, sinus rhythm, a non-LBBB pattern with a QRS greater than or equal to 150 msec, and NYHA functional class III/ambulatory class IV symptoms on GDMT (4-7). *(Level of Evidence: A)*

Class IIb

- CRT may be considered for patients who have LVEF less than or equal to 35%, sinus rhythm, a non-LBBB with a QRS duration greater than or equal to 150 msec, and NYHA functional class II symptoms on GDMT (7-8). *(Level of Evidence: B)*

2008 DEVICE-BASED THERAPY GUIDELINES:

2.4.1 Recommendations for Cardiac Resynchronization Therapy in Patients With Severe Systolic Heart Failure

CLASS IIa

- For patients who have LVEF less than or equal to 35%, a QRS duration greater than or equal to 0.12 seconds, and AF, CRT with or without an ICD is reasonable for the treatment of NYHA functional Class III or ambulatory Class IV heart failure symptoms on optimal recommended medical therapy. (*Level of Evidence: B*) (10-11)
- For patients with LVEF less than or equal to 35% with NYHA functional Class III or ambulatory Class IV symptoms who are receiving optimal recommended medical therapy and who have frequent dependence on ventricular pacing, CRT is reasonable. (*Level of Evidence: C*) (10)

CLASS IIb

- For patients with LVEF less than or equal to 35% with NYHA functional Class I or II symptoms who are receiving optimal recommended medical therapy and who are undergoing implantation of a permanent pacemaker and/or ICD with anticipated frequent ventricular pacing, CRT may be considered. (*Level of Evidence: C*) (10)

2009 HEART FAILURE GUIDELINES:

4.3.1. Patients With Reduced Left Ventricular Ejection Fraction

CLASS I

- Patients with LVEF of less than or equal to 35%, sinus rhythm, and NYHA functional class III ambulatory class IV symptoms despite recommended optimal medical therapy and who have cardiac dyssynchrony, which is currently defined as a QRS duration greater than or equal to 0.12 seconds, should receive cardiac resynchronization therapy, with or without an ICD,

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unless contraindicated (4-6,12-24). (*Level of Evidence: A*)

CLASS IIa

- For patients with LVEF of less than or equal to 35% with NYHA functional class III or ambulatory class IV symptoms who are receiving optimal recommended medical therapy and who have frequent dependence on ventricular pacing, CRT is reasonable (10) (*Level of Evidence: C*)

2004 STEMI GUIDELINES:

7.7.3.2.3. Pacing Mode Selection in STEMI Patients

Class IIa

- It is reasonable to evaluate all patients who have an indication for permanent pacing after STEMI for biventricular pacing (cardiac resynchronization therapy). (*Level of Evidence: C*)

No Other Indication for Ventricular Pacing LVEF 36-50%
232. QRS 120-149 msec LBBB
Not addressed in guidelines
233. QRS ≥150 msec LBBB
Not addressed in guidelines
234. QRS 120-149 msec Non-LBBB
Not addressed in guidelines
235. QRS ≥150 msec Non-LBBB
Not addressed in guidelines

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