



CLINICAL GUIDELINES

Cardiac Rhythm Implantable Device (CRID) Policy

Version 19.0 | Effective May 22nd, 2017



eviCore healthcare Clinical Decision Support Tool Diagnostic Strategies: This tool addresses common symptoms and symptom complexes. Imaging requests for individuals with atypical symptoms or clinical presentations that are not specifically addressed will require physician review. Consultation with the referring physician, specialist and/or individual's Primary Care Physician (PCP) may provide additional insight.

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CARDIAC RHYTHM IMPLANTABLE DEVICE (CRID) GUIDELINES

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ABBREVIATIONS

ACE inhibitor	angiotensin-converting enzyme inhibitor
AMI	acute myocardial infarction
ARVC	arrhythmogenic right ventricular cardiomyopathy
CC	complications/comorbid conditions
CHF	congestive heart failure
CM	cardiomyopathy
CRT	cardiac resynchronization therapy
EP	electrophysiology
ICD	implantable cardioverter defibrillator
LV	left ventricular
LVEF	left ventricular ejection fraction
MCC	major complications/comorbid conditions
MI	myocardial infarction
NCCM	non-compaction cardiomyopathy
NYHA	New York Heart Association functional classification
VF	ventricular fibrillation
VT	ventricular tachycardia

GLOSSARY

Class	NYHA Heart Failure Definitions
I	No symptoms and no limitation in ordinary physical activity, e.g. shortness of breath when walking, climbing stairs etc.
II	Mild symptoms (mild shortness of breath and/or angina) and slight limitation during ordinary activity.
III	Marked limitation in activity due to symptoms, even during less-than-ordinary activity, e.g. walking short distances (20–100 m). Comfortable only at rest.
IV	Severe limitations. Experiences symptoms even while at rest. Mostly bedbound patients
Abnormal blood pressure response to exercise: Flat response/failure to augment; rise then fall during exercise; vasoactive cardiovascular drugs may result in an abnormal blood pressure response to exercise	
Non-Sustained Ventricular Tachycardia (NSVT): Three or more consecutive ventricular beats at a rate of greater than 120 beats/min with a duration of less than 30 seconds	
Incessant VT: Frequent recurrences of ongoing hemodynamically stable VT	
Long QT Syndrome (LQTS): A congenital disorder characterized by a prolongation of the QT interval on ECG and a propensity to ventricular tachyarrhythmias, which may lead to syncope, cardiac arrest, or sudden death. The QT interval on the ECG, measured from the beginning of the QRS complex to the end of the T wave, represents the duration of activation and recovery of the ventricular myocardium. QT intervals corrected for heart rate (QTc) longer than 0.44 seconds are generally considered abnormal, though a normal QTc can be more prolonged in females (up to 0.46 sec). The Bazett formula is the formula most commonly used to calculate the QTc, as follows: $QTc = AT / \text{square root of the R-R interval (in seconds)}$.	
Optimal Medical Therapy: Three months of heart failure medications in maximally titrated doses as tolerated. These include beta blockers, ACE inhibitors or ARBs, and diuretics.	
Structural Heart Disease: A structural or functional abnormality of the heart, or of the blood vessels supplying the heart, that impairs its normal functioning.	
Non-Compaction Cardiomyopathy: A rare congenital cardiomyopathy that affects children and adults. It results from the failure of myocardial development during embryogenesis. It is also called spongiform cardiomyopathy. Symptoms are often a result of a poor pumping performance by the heart. The disease can be associated with other problems with the heart and the body.	

CARDIAC RHYTHM IMPLANTABLE DEVICE (CRID) GUIDELINES

PREFACE to the eviCore 2016 CRID Guidelines

PREFACE-1~Guideline Development

- ✓ The eviCore evidence-based, proprietary clinical guidelines evaluate a range of advanced imaging and procedures, including CT, MRI, PET, and Radiation Oncology, Sleep Studies and Cardiac and Spine interventions.
- ✓ eviCore healthcare reserves the right to change and update the guidelines. The guidelines undergo a formal review annually. eviCore's guidelines are based upon major national and international association and society guidelines and criteria, peer-reviewed literature, major treatises and, input from health plans, practicing academic and community-based physicians.
- ✓ These Guidelines are not intended to supersede or replace sound medical judgment, but instead, should facilitate the identification of the most appropriate imaging procedure given the patient's clinical condition. These guidelines are written to cover medical conditions as experienced by the majority of patients. However, these guidelines may not be applicable in certain clinical circumstances, and physician judgment can override the guidelines.
- ✓ Clinical decisions, including treatment decisions, are the responsibility of the patient and his/her provider. Clinicians are expected to use independent medical judgment which takes into account the clinical circumstances to determine patient management decisions.
- ✓ eviCore supports the Choosing Wisely initiative (www.choosingwisely.org) by the American Board of Internal Medicine (ABIM) Foundation and many national physician organizations, to reduce the overuse of diagnostic tests that are low value, no value, or whose risks are greater than the benefits.
- ✓ eviCore's guidelines are based upon expert consensus and analysis reported by the following specialty societies, publications, studies and trials:
 - o The American College of Cardiology (ACC)
 - o The American Heart Association (AHA)
 - o The Heart Rhythm Society (HRS)
 - o The Multicenter Automatic Defibrillator Implantation Trial (MADIT/MADIT-2)
 - o The Multicenter Unsustained Tachycardia Trial (MUSTT)
 - o The Defibrillator in Acute Myocardial Infarction Trial (DINAMIT)

- o The Resynchronization/defibrillation for Ambulatory Heart Failure Trial (RAFT)
- o The Sudden Cardiac Death in Heart Failure Trial (SCD-HeFT)
- o The Resynchronization Reverses Remodeling in Systolic Left Ventricular Dysfunction trial (REVERSE)
- o Immediate Risk Stratification Improves Survival trial (IRIS)
- o The Comparison of Medical Therapy, Pacing, and Defibrillation in Heart Failure trial (COMPANION)
- o The Antiarrhythmics Versus Implantable Defibrillators trial (AVID)
- o The Canadian Implantable Defibrillator Study (CIDS)
- o The Cardiac Arrest Study Hamburg (CASH)

PREFACE-2~Benefits, Coverage Policies, and Eligibility Issues

- ✓ Benefits, coverage policies, and eligibility issues pertaining to each Health Plan may take precedence over eviCore's guidelines. Providers are urged to obtain written instructions and requirements directly from each payer.
- ✓ Medicare Coverage Policies
 - o For Medicare and Medicare Advantage enrollees, the coverage policies of CMS (Centers for Medicare and Medicaid Services) may take precedence over eviCore's guidelines.
 - o Payers may choose to adopt other evidence-based guidelines (such as eviCore's guidelines) rather than using Local Coverage Determinations and other Medicare coverage policy.
- ✓ Investigational and Experimental Studies
 - o Certain imaging studies described in these guidelines are considered investigational by various payers, and their coverage policies may take precedence over eviCore's guidelines.
- ✓ Clinical and Research Trials
 - o Similar to investigational and experimental studies, clinical trial imaging requests will be considered to determine whether they meet Health Plan coverage and eviCore's evidence-based guidelines.
- ✓ State and federal legislations may need to be considered in the review of advanced imaging requests.

PREFACE-3~Clinical Information

- ✓ The philosophy behind eviCore guidelines entails using an evidence-based approach to determine the most appropriate procedure for each individual, at the most appropriate time in the diagnostic and treatment cycle.
- ✓ Procedures should be requested after initial consultation and physician treatment planning, and following full counseling of the individual.
- ✓ Current clinical information, which may include history, physical examination, symptoms, laboratory results, and imaging reports, are necessary for determining the medical necessity of implantable cardioverter defibrillator (ICD) devices and cardiac resynchronization therapy (CRT-D).
- ✓ The information provided to eviCore should have clinical relevance to the request.
- ✓ If the information provided makes no reference to the potential indication for the request, then the medical necessity for the procedure(s) cannot be supported.
- ✓ These clinical guidelines are not intended to supersede or replace sound medical judgment, but instead, should facilitate the identification of the most appropriate procedure given the individual's clinical condition.
- ✓ These guidelines are written to cover medical conditions as experienced by the majority of individuals. However, these guidelines may not be applicable in certain clinical circumstances, and physician judgment can override the guidelines.
- ✓ Clinical decisions, including treatment decisions, are the responsibility of the patient and his/her provider. Clinicians are expected to use independent medical judgment which takes into account the clinical circumstances to determine patient management decisions.

PREFACE-6~References

- ✓ References are embedded within the body of the guidelines.

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CARDIAC RHYTHM IMPLANTABLE DEVICE (CRID) GUIDELINES**CRID-1~PROCEDURE CODES****Procedure Codes (CPT®)**

The CPT® code set **33202-33249** includes the various Pacemaker and Defibrillator procedures including the insertion, replacement and removal of the leads. Some of the codes apply to both the pacemaker and the defibrillator. Codes are included for informational purposes only and any given code's inclusion on this list does not necessarily indicate prior authorization is required. Pre-authorization requirements vary by health plan.

CPT®	DESCRIPTION
33206	Insertion of new or replacement of permanent pacemaker with transvenous electrode(s); atrial
33207	Insertion of new or replacement of permanent pacemaker with transvenous electrode(s); ventricular
33208	Insertion of new or replacement of permanent pacemaker with transvenous electrode(s); atrial and ventricular
33212	Insertion of pacemaker pulse generator only; single existing single lead
33213	Insertion of pacemaker pulse generator only; with existing dual leads
33214	Upgrade of implanted pacemaker system, conversion of single chamber system to dual chamber system (includes removal of previously placed pulse generator, testing of existing lead, insertion of new lead, insertion of new pulse generator)
33227	Removal of permanent pacemaker pulse generator with replacement of pacemaker pulse generator; single lead system
33228	Removal of permanent pacemaker pulse generator with replacement of pacemaker pulse generator; dual lead system
33215	Repositioning of previously implanted transvenous pacemaker or pacing cardioverter-defibrillator (right atrial or right ventricular) electrode
33216	Insertion of a single transvenous electrode; permanent pacemaker or cardioverter-defibrillator
33217	Insertion of 2 transvenous electrodes, permanent pacemaker or cardioverter-defibrillator
33218	Repair of single transvenous electrode, permanent pacemaker or pacing cardioverter-defibrillator
33220	Repair of 2 transvenous electrodes for permanent pacemaker or pacing cardioverter-defibrillator
33221	Insertion of pacemaker pulse generator only; with existing multiple leads
33222	Revision or relocation of skin pocket for pacemaker
33223	Revision of skin pocket for cardioverter-defibrillator
33224	Insertion of pacing electrode, cardiac venous system, for left ventricular pacing, with attachment to previously placed pacemaker or pacing cardioverter-defibrillator pulse generator

List continued next page . . .

Procedure Codes (CPT®) *Continued from previous page*

The CPT® code set **33202-33249** includes the various Pacemaker and Defibrillator procedures including the insertion, replacement and removal of the leads. Some of the codes apply to both the pacemaker and the defibrillator. Codes are included for informational purposes only and any given code's inclusion on this list does not necessarily indicate prior authorization is required. Pre-authorization requirements vary by health plan.

CPT®	DESCRIPTION
33225	Insertion of pacing electrode, cardiac venous system, for left ventricular pacing, at time of insertion of pacing cardioverter-defibrillator pulse generator (including upgrade to dual chamber system and pocket revision)
33226	Repositioning of previously implanted cardiac venous system (left ventricular) electrode (including removal, insertion and/or replacement of existing generator)
33229	Removal of permanent pacemaker pulse generator with replacement of pacemaker pulse generator; multiple lead system
33230	Insertion of pacing cardioverter-defibrillator pulse generator only; with existing dual leads
33231	Insertion of pacing cardioverter-defibrillator pulse generator only; with existing multiple leads
33233	Removal of permanent pacemaker pulse generator only
33236	Removal of permanent epicardial pacemaker and electrodes by thoracotomy; single lead system, atrial or ventricular
33237	Removal of permanent epicardial pacemaker and electrodes by thoracotomy; dual lead system
33238	Removal of permanent transvenous electrode(s) by thoracotomy
33240	Insertion of pacing cardioverter-defibrillator pulse generator only; with existing single leads
33241	Removal of pacing cardioverter-defibrillator pulse generator only
33243	Removal of single or dual chamber pacing cardioverter-defibrillator electrode(s); by thoracotomy
33244	Removal of single or dual chamber pacing cardioverter-defibrillator electrode(s); by transvenous extraction
33249	Insertion or replacement of permanent pacing cardioverter-defibrillator system with transvenous lead(s), single or dual chamber
33262	Removal of pacing cardioverter-defibrillator pulse generator with replacement of pacing cardioverter-defibrillator pulse generator; single lead system
33263	Removal of pacing cardioverter-defibrillator pulse generator with replacement of pacing cardioverter-defibrillator pulse generator; dual lead system
33264	Removal of pacing cardioverter-defibrillator pulse generator with replacement of pacing cardioverter-defibrillator pulse generator; multiple lead system
33270	Insertion or replacement of permanent subcutaneous implantable defibrillator system, with subcutaneous electrode, including defibrillation threshold evaluation, induction of arrhythmia, evaluation of sensing for arrhythmia termination, and

	programming or reprogramming of sensing or therapeutic parameters when performed
33271	Insertion of subcutaneous implantable defibrillator electrode
33240	Insertion of implantable defibrillator pulse generator only; with existing single lead
33241	Removal of implantable defibrillator pulse generator only
33262	Removal of implantable defibrillator pulse generator with replacement of implantable defibrillator pulse generator; single lead system
33272	Removal of subcutaneous implantable defibrillator electrode
33273	Repositioning of previously implanted subcutaneous implantable defibrillator electrode

ICD-9-CM Procedure Codes

ICD-9-CM	DESCRIPTION
37.7	Insertion, revision, replacement, and removal of leads; insertion of temporary pacemaker system; or revision of cardiac device pocket
37.70	Initial insertion of lead [electrode]. not otherwise specified
37.71	Initial insertion of lead [electrode] into ventricle
37.72	Initial insertion of transvenous leads [electrodes] into atrium and ventricle
37.73	Initial insertion of transvenous lead [electrode] into atrium
37.74	Insertion or replacement of epicardial lead [electrode] into epicardium
37.75	Revision of lead [electrode]
37.76	Replacement of transvenous atrial and/or ventricular lead(s) [electrodes]
37.77	Removal of leads(s) [electrodes] without replacement
37.78	Insertion of temporary transvenous pacemaker system
37.79	Revision or relocation of cardiac device pocket
37.8	Insertion, replacement, removal, and revision of pacemaker device
37.80	Insertion of permanent pacemaker, initial or replacement, type of device not specified
37.81	Initial insertion of single chamber device, not specified as rate responsive
37.82	Initial insertion of single chamber device, rate responsive
37.83	Initial insertion of dual chamber device
37.85	Replacement of any type pacemaker device with single chamber device, not specified as rate responsive
37.86	Replacement of any type pacemaker device with single chamber device, rate responsive
37.87	Replacement of any type pacemaker device with dual chamber device
37.89	Revision or removal of pacemaker device

FY 2014 MS-DRG Codes

DRG	ICD & CRT System Implants
222	Cardiac defib implant w cardiac cath w AMI/HF/shock w MCC
223	Cardiac defib implant w cardiac cath w AMI/HF/shock w/o MCC
224	Cardiac defib implant w cardiac cath w/o AMI/HF/shock w MCC
225	Cardiac defib implant w cardiac cath w/o AMI/HF/shock w/o MCC
226	Cardiac defibrillator implant w/o cardiac cath w MCC
227	Cardiac defibrillator implant w/o cardiac cath w/o MCC
DRG	ICD Replacements
245	AICD generator procedures
253	ICD lead procedures

CARDIAC RHYTHM IMPLANTABLE DEVICE (CRID) GUIDELINES

CRID-2~Definite Indications for ICD Implantation

CRID-2.1 Survivors of Cardiac Arrest

- ✓ ICD implantation is indicated in individuals who are survivors of cardiac arrest due to ventricular tachycardia (VT) or ventricular fibrillation (VF) after evaluation has excluded any completely reversible causes.

References:

- *Am J Cardiol* 1997;79:661-663
- *Am J Cardiol* 2000;101:1297-1302
- *Circulation* 2000;102:748-754

CRID-2.2 Structural Heart Disease with Sustained VT

- ✓ ICD implantation is indicated in individuals with structural heart disease (such as prior myocardial infarction (MI), congenital heart disease, and/or ventricular dysfunction) and spontaneous, sustained VT (greater than 30 seconds), whether hemodynamically stable or unstable.

References:

- *Am J Cardiol* 1997;79:661-663
- *Am J Cardiol* 2000;101:1297-1302
- *Circulation* 2000;102:748-754

CRID-2.3 Syncope of Undetermined Origin and Positive EP Study

- ✓ ICD implantation is indicated in individuals with syncope of undetermined origin who have clinically relevant, hemodynamically significant sustained VT or VF induced at electrophysiology (EP) study.

Reference:

- *Circulation* 2008;117:e349-408

CRID-2.4 Unexplained Syncope

- ✓ ICD implantation is indicated in individuals with unexplained syncope, significant left ventricular (LV) dysfunction (LV ejection fraction less than 50%), and structural heart disease such as prior myocardial infarction (MI), congenital heart disease, and/or ventricular dysfunction.

Reference:

- *Circulation* 2008;117:e349-408

CRID-2.5 Ischemic Cardiomyopathy

- ✓ ICD implantation is indicated in individuals with the following:
 - LV dysfunction due to prior myocardial infarction (MI), **and**
 - LV ejection fraction less than or equal to 35%, **and**
 - At least 40 days post-MI, **and**
 - Are NYHA functional Class II or III, **and**
 - Are on optimal medical therapy, defined as 3 months of maximally titrated doses as tolerated of an ACE inhibitor, beta-blocker, and diuretic
- or**
- LV dysfunction due to prior MI, **and**
 - LV ejection fraction less than or equal to 30%, **and**
 - At least 40 days post-MI, **and**
 - Are NYHA functional Class I
- or**
- Have non-sustained VT due to prior MI, **and**
 - LV ejection fraction less than or equal to 40%, **and**
 - Have inducible VF or sustained VT at EP study performed at least 96 hours after revascularization or MI

References:

- *N Engl J Med* 2009;361:1329-1338
- *N Engl J Med* 2005;352:225-237
- *Card Electrophysiol Rev* 2004;7(4):447-451
- *N Engl J Med* 2000;342:1937-1945
- *N Engl J Med* 2009;361:1427-1436

CRID-2.6 Nonischemic Dilated Cardiomyopathy (DCM)

- ✓ ICD implantation is indicated in individuals with nonischemic dilated cardiomyopathy who have LV ejection fraction less than or equal to 35%, NYHA Class II or III CHF and who are on optimal medical therapy. Trials assessing ICD therapy in primary prophylaxis of DCM have not generally included asymptomatic, NYHA functional Class I patients.

Reference:

- *Circulation* 2008;117:e349-408
- Optimal medical therapy is defined as 3 months of maximally titrated doses as tolerated of an ACE inhibitor, beta-blocker, and diuretic.

CRID-3~Reasonable Indications for ICD Implantation

CRID-3.1 General Considerations

- ✓ For the “reasonable” or “considered” indications listed in this CRID-3 guideline, consensus opinion is less clear about the use of ICD implantation in these settings. Limited evidence suggests that ICD placement may be reasonable or may be considered; this category includes VF or hypotensive VT events where pharmaceutical or ablative techniques are indicated but the results of treatment are too unpredictable to withhold ICD implantation.

CRID-3.2 Sustained Ventricular Tachycardia with Normal LV Function

- ✓ ICD implantation is reasonable for individuals with sustained VT and normal or near-normal ventricular function.

Reference:

- *Circulation* 2008;117:e349-408

CRID-3.3 Cardiomyopathy

- ✓ **Cardiomyopathy due to Hypertrophic Cardiomyopathy:** ICD implantation is reasonable for individuals with hypertrophic cardiomyopathy who have one or more risk factors for sudden cardiac death
 - Risk factors for sudden cardiac death include the following:
 - Unheralded syncope
 - Family history of sudden death
 - Septal wall thickness of greater than or equal to 30 mm
 - Abnormal blood pressure response to exercise
 - Nonsustained VT (< 30 seconds)
- ✓ **Cardiomyopathy due to Arrhythmogenic Right Ventricular Cardiomyopathy (ARVC):** ICD implantation is reasonable for individuals with ARVC who have one or more risk factors for sudden cardiac death
 - Risk factors for sudden cardiac death include the following:
 - Unheralded syncope
 - Family history of sudden death
 - Nonsustained VT (< 30 seconds)
 - Clinical signs of RV failure

Reference:

- [Circulation 2008;117:e349-408](#)

CRID-3.4 Long QT Syndrome

- ✓ ICD implantation is reasonable in Long-QT Syndrome in the following settings:
 - o Syncope and/or VT while receiving beta-blockers or if beta-blockers are contraindicated, **or**
 - o Asymptomatic with other risk factors for sudden cardiac death.
 - Risk factors for sudden cardiac death include the following:
 - QTc greater than 500 msec, or
 - LQT 2 or 3
 - Family history of sudden death

Reference:

- [Circulation 2008;117:e349-408](#)

CRID-3.5 Brugada's Syndrome

- ✓ ICD implantation is reasonable for individuals with Brugada Syndrome who have had syncope or who have documented or inducible VT or VF.

Reference:

- [Circulation 2008;117:e349-408](#)

CRID-3.6 Catecholaminergic Polymorphic Ventricular Tachycardia

- ✓ ICD implantation is reasonable for individuals with catecholaminergic polymorphic VT who have syncope and/or documented sustained VT while receiving beta-blockers.

Reference:

- [Circulation 2008;117:e349-408](#)

CRID-3.7 Other Indications

- ✓ ICD implantation is reasonable for individuals with cardiac sarcoidosis, giant cell myocarditis, or Chagas disease, regardless of LV ejection fraction measurement.
- ✓ **LV non compaction**
 - o ICD implantation should be considered for the primary prevention of sudden cardiac death due to malignant ventricular arrhythmias in individuals with non-compaction cardiomyopathy and impaired LV function (LV ejection fraction less than 50%).
 - ICD implantation is also indicated for normal LV function (LVEF greater than 50%), primary prevention cases with positive family history of sudden cardiac death. This exception is due to the presence of sarcomeric gene mutations reported in non-compaction cardiomyopathy.

References:

- *Circulation* 2008;117: e349-408
- *J Cardiovasc Electrophysiol* 2011;22:898-904

CRID-3.8 Familial Cardiomyopathy

- ✓ ICD implantation may be considered in affected individuals with a familial cardiomyopathy associated with sudden death.

Reference:

- *Circulation* 2008;117:e349-408

CARDIAC RHYTHM IMPLANTABLE DEVICE (CRID) GUIDELINES

CRID-4~ICD IMPLANTATION—*Non-Indications*

CRID-4.1 Ischemic Cardiomyopathy

- ✓ ICD implantation is **NOT** indicated in individuals who have had a myocardial infarction within the past 40 days or who have had coronary revascularization within the past 90 days **UNLESS** the following applies:
 - A separate indication for permanent pacemaker implantation exists (thus preventing a likely repeat procedure for an upgraded device in the near future)

CRID-4.2 NYHA Class IV CHF

- ✓ ICD implantation is **NOT** indicated for individuals with NYHA functional class IV symptoms **UNLESS** one of the following applies:
 - It is a CRT-D device meeting the indications for CRT-D implantation listed in ICD-5.1 Dilated Cardiomyopathy with NYHA Class III or IV Congestive Heart Failure (CHF), *or*
 - The individual is awaiting heart transplantation, *or*
 - Left ventricular assist device (LVAD) is being used as destination therapy

CRID-4.3 Limited Life Expectancy

- ✓ ICD implantation is **NOT** indicated for individuals who do not have a reasonable expectation of survival with an acceptable functional status for at least one year, even if they meet ICD implantation criteria listed in:
 - **CRID-2 Definite Indications for ICD Implantation** *or*
 - **CRID-3 Reasonable Indications for ICD Implantation**

CRID-4.4 Incessant VT or VF

- ✓ ICD implantation is **NOT** indicated for individuals with incessant VT or VF
 - Incessant VT or VF is defined as hemodynamically stable VT or VF continuing for hours.

CRID-4.5 Psychiatric Conditions

- ✓ ICD implantation is **NOT** indicated in individuals with significant psychiatric illnesses that may be aggravated by device implantation or that may preclude systematic follow-up.

CRID-4.6 Reversible Cause of VT/VF

- ✓ ICD implantation is **NOT** indicated when VF or VT is due to a reversible cause
 - Sudden death can occur secondary to reversible derangements such as severe electrolyte disturbance or acute, reperfused myocardial infarction with preserved ejection fraction.

CRID-4.7 Ablation Candidate, No Structural Heart Disease

- ✓ ICD implantation is NOT indicated if the individual has no structural heart disease and is a candidate for ablation. Surgical or catheter ablation can be curative in this setting.

For CRID-4.1 through 4.7, see references in **CRID-2**

CARDIAC RHYTHM IMPLANTABLE DEVICE (CRID) GUIDELINES

CRID-5~Indications for Cardiac Resynchronization Therapy (CRT)-D or (CRT)-P Implantation

CRID-5.1 Dilated Cardiomyopathy with NYHA Class III or IV Congestive Heart Failure (CHF)

- ✓ CRT-D or CRT-P implantation is indicated in individuals with ischemic or nonischemic dilated cardiomyopathy who have **ALL** of the following:
 - Non-right bundle branch block with QRS greater than or equal to 120 msec, ***and***
 - LV ejection fraction less than or equal to 35%, ***and***
 - Are NYHA functional Class III or IV on stable optimal medical therapy
 - Optimal medical therapy is defined as 3 months of maximally titrated doses as tolerated of an ACE inhibitor/angiotensin II receptor blocker, beta-blocker, and diuretic.
 - Optimal medical therapy is defined as 3 months of maximally titrated doses as tolerated of an ACE inhibitor/angiotensin II receptor blocker, beta-blocker, and diuretic.

Reference:

- *N Engl J Med* 2004;350:2140-2150

CRID-5.2 Dilated Cardiomyopathy with NYHA Class II Congestive Heart Failure (CHF)

- ✓ CRT-D implantation is indicated in individuals with ischemic or nonischemic dilated cardiomyopathy who have **ALL** of the following:
 - Left bundle branch block with QRS greater than or equal to 120 msec, ***and***
 - LV ejection fraction less than or equal to 30%, ***and***
 - Are NYHA functional Class II on stable optimal medical therapy

References:

- *Circulation* 2011;123:1061-1072
- *N Engl J Med* 2005;352:225-237
- *N Engl J Med* 2010;363:2385-2395
- *Am Heart J* 2006;151:288-294
- *BCBSA TEC CRT July 2011;26(1):1-28*
- *N Engl J Med* 2013;368:1585-93. (DOI: 10.1056/NEJMoa1210356)

CARDIAC RHYTHM IMPLANTABLE DEVICE (CRID) GUIDELINES

CRID-6~CARDIAC RESYNCHRONIZATION THERAPY (CRT)- D or (CRT)-P IMPLANTATION—*Non-Indications*

CRID-6.1 Ischemic Cardiomyopathy

- ✓ CRT-D or CRT-P implantation is **NOT** indicated in individuals who have had a myocardial infarction within the past 40 days or who have had coronary revascularization within the past 90 days **UNLESS** the following applies:
 - A separate indication for permanent pacemaker implantation exists (thus preventing a likely repeat procedure for an upgraded device in the near future)

CRID 6.2 Reversible Causes of Cardiomyopathy

- ✓ CRT-D implantation is not indicated in the setting of a reversible CM such as: toxic, metabolic or tachycardia induced cardiomyopathy.
 - Once the reversible aberration is corrected, clinical reassessment is indicated.

For CRID-6.1 and 6.2, see references in **CRID-5**

CARDIAC RHYTHM IMPLANTABLE DEVICE (CRID) GUIDELINES

CRID-7~Definite Indications for Permanent Pacemaker Implantation

CRID-7.1 Symptomatic Bradycardia

- ✓ Permanent pacemaker implantation is indicated for symptomatic bradycardia, including frequent sinus pauses that produce symptoms and any degree of AV block producing symptoms.

References:

- *Am Heart J* 1982;103:338-42
- *N Engl J Med* 1996;334:89-97
- *Euro Heart J* 1981;2:455-9
- *Brit Heart J* 1991;66:185-91

- ✓ Permanent pacemaker implantation is indicated for symptomatic bradycardia that results from required drug therapy for medical conditions (for example, beta blocker therapy in patients with prior myocardial infarction).

References:

- *Brit Heart J* 1991;66:185-91
- *Circulation* 2008;117:e350-408

CRID-7.2 Symptomatic Chronotropic Incompetence

- ✓ Permanent pacemaker implantation is indicated for symptomatic chronotropic incompetence defined as limitations due to the inability to achieve 80% of maximum predicted heart rate (220-age).

Reference:

- *PACE* 1992;15:905-15

CRID-7.3 Indications for Asymptomatic Patients

- ✓ Permanent pacemaker implantation is indicated for asymptomatic patients with third degree AV block.

References:

- *Brit Heart J* 1991;66:185-91
- *Circulation* 2008;117:e350-408
- *N Engl J Med* 1975;292:572-4
- *N Engl J Med* 1975;292:462-5
- *Am J Cardiol* 1997;80:1309-13
- *Am J Cardiol* 1976;38:205-8

- *Am J Cardiol* 1991;67:225-30

- ✓ Permanent pacemaker implantation is indicated for asymptomatic patients with advanced second degree AV block (Mobitz type II) and intermittent third degree AV block

References:

- *Circulation* 2008;117:e350-408
- *N Engl J Med* 1975;292:572-4
- *N Engl J Med* 1975;292:462-5

- ✓ Permanent pacemaker implantation is indicated for asymptomatic patients with second degree AV block and documented periods of asystole greater than or equal to 3.0 seconds.

References:

- *Circulation* 1979;60:465-72
- *Circulation* 1981;63:1043-9
- *PACE* 1983;6:548-51

- ✓ Permanent pacemaker implantation is indicated for second degree AV block in awake, symptom-free patients with atrial fibrillation and a pause of 5 seconds or longer.

Reference:

- *Circulation* 2008;117:e350-408

- ✓ Permanent pacemaker implantation is indicated for alternating bundle branch block in asymptomatic patients.

Reference:

- *Circulation* 2008;117:e350-408

- ✓ Permanent pacemaker implantation is indicated for asymptomatic patients with second degree AV block at any anatomic level associated with neuromuscular diseases known to involve the heart

References:

- *Am J Cardiol* 1984;54:1074-81
- *Am Heart J* 1987;113:1482-8
- *J Am Coll Cardiol* 1990;15:292-9
- *Am Heart J* 1963;66:164-75
- *Am J Cardiol* 1979;44:1396-400
- *Circulation* 1981;63:214-9

CRID-7.4 Prior to Planned Catheter Ablation

- ✓ Permanent pacemaker implantation is indicated prior to a planned catheter ablation of the AV junction intended for a rate control strategy for management of atrial fibrillation.

Reference:

- *Circulation* 1989;80:1527-35

CRID-7.5 Persistent Second Degree AV Block

- ✓ Permanent pacemaker implantation is indicated for persistent second degree AV block in the His-Purkinje system with alternating bundle branch block or third degree AV block within or below the His-Purkinje system after myocardial infarction.

References:

- *Am J Cardiol* 1976;38:205-8
- *Am J Cardiol* 1991;67:225-30
- *Am J Cardiol* 1972;29:344-50
- *Am J Cardiol* 1986;57:1213-9

CRID-7.6 Syncope

- ✓ Permanent pacemaker implantation is indicated for syncope caused by spontaneously occurring carotid sinus stimulation and carotid sinus pressure that induces ventricular asystole of more than 3 seconds.

Reference:

- *Circulation* 2008;117:e350-408

CARDIAC RHYTHM IMPLANTABLE DEVICE (CRID) GUIDELINES

CRID-8~Reasonable Indications for Permanent Pacemaker Implantation

CRID-8.1 General Considerations

- ✓ For the “reasonable” or “considered” indications listed in this CRID-8 guideline, consensus opinion is less clear about permanent pacing in these settings, with evidence suggesting that device placement may be reasonable or may be considered.

CRID-8.2 Sinus Node Dysfunction

- ✓ Permanent pacemaker implantation is reasonable for individuals with sinus node dysfunction with a resting heart rate of less than 40 bpm when periodic symptomatic bradycardia is suspected.

References:

- [*Am Heart J* 1982;103:338-42](#)
- [*Euro Heart J* 1981;2:455-9](#)

CRID-8.3 Syncope

- ✓ Permanent pacemaker implantation may be reasonable or may be considered for individuals with syncope in the following settings:
 - o Syncope of unexplained origin when clinically significant abnormalities of sinus node function are discovered or provoked in electrophysiological studies

References:

- [*PACE* 1994;17:349-65](#)
- [*Circulation* 1978;58:689-99](#)

- o Syncope without clear, provocative events and with a hypersensitive cardioinhibitory response of 3 seconds or longer

References:

- [*Brit Heart J* 1991;66:185-91](#)
- [*Circulation* 2008;117:e350-408](#)

- o Significantly symptomatic neurocardiogenic syncope associated with Bradycardia documented spontaneously or at the time of tilt table testing

Reference:

- [*Am J Cardiol* 1998;81:158-62](#)

CRID-8.4 Asymptomatic Second Degree AV Block

- ✓ Permanent pacemaker implantation is reasonable for individuals with asymptomatic second degree AV block at intra- or infra- His levels found at electrophysiological study.

References:

- *Circulation* 1979;60:465-72
- *Circulation* 1972;45:282-94

CRID-8.5 First or Second AV Block

- ✓ Permanent pacemaker implantation is reasonable for individuals with first or second degree AV block with symptoms similar to those of pacemaker syndrome.

References:

- *Circulation* 1981;63:1043-9
- *PACE* 1996;19:747-51
- *N Engl J Med* 1986;315:1183-7
- *PACE* 1996;19:261-4

CRID-8.6 Symptomatic Recurrent SVT

- ✓ Permanent pacemaker implantation is reasonable for individuals with symptomatic recurrent SVT that is reproducibly terminated by pacing when catheter ablation and/or drugs fail to control the arrhythmia or produce intolerable side effects.

References:

- *Am J Cardiol* 1987;60:1311-6
- *J Am Coll Cardiol* 1985;6:206-14
- *Am J Cardiol* 1986;58:70-4

CRID-8.7 Relative Bradycardia – Postoperative Cardiac Transplant

- ✓ Permanent pacemaker implantation may be considered for individuals when relative bradycardia is prolonged or recurrent, which limits rehabilitation or discharge after postoperative recovery from cardiac transplantation.

References:

- *J Am Coll Cardiol* 1994;24:1334-41
- *J Heart Lung Trans* 1991;10:931-6
- *PACE* 1981;7:1296-300

CRID-8.8 Incidental Finding at Electrophysiology (EP) Study

- ✓ Permanent pacemaker implantation may be reasonable for an incidental finding at electrophysiology study of a markedly prolonged HV interval (greater than or equal to 100 milliseconds) or non-physiological intra- or infra- Hisian block in asymptomatic patients.

References:

- *Am Heart J* 1983;106:693-7
- *Circulation* 1977;56:240-4
- *Circulation* 1979;60:1455-64
- *Am Heart J* 1979;97:19-26

CRID-8.9 Neuromuscular Diseases Known to Involve the Heart

- ✓ Permanent pacemaker implantation may be considered for progressive neuromuscular diseases known to involve the heart* with any degree of AV block (including first degree AV block) or any fascicular block, with or without symptoms, because there may be unpredictable progression of AV conduction disease.
- ✓ *Progressive neuromuscular diseases known to involve the heart include myotonic muscular dystrophy, Kearns-Sayre syndrome, Erb dystrophy (limb-girdle muscular dystrophy), and peroneal muscular atrophy.

References:

- *Am J Cardiol* 1984;54:1074-81
- *Am Heart J* 1987;113:1482-8
- *J Am Coll Cardiol* 1990;15:292-9
- *Am Heart J* 1963;66:164-75
- *Am J Cardiol* 1979;44:1396-400
- *Circulation* 1981;63:214-9

CRID 8.10 Cardiomyopathy with a history of heart failure and an LV Ejection Fraction less than 50% on optimal medical therapy:

- ✓ CRT-P implantation is indicated in individuals who have a history of heart failure with an EF less than 50% on optimal medical therapy and **ONE** of the following:
 - Planned atrioventricular node ablation
 - Anticipated requirement for 40% or greater ventricular pacing

CARDIAC RHYTHM IMPLANTABLE DEVICE (CRID) GUIDELINES

CRID-9~PERMANENT PACEMAKER IMPLANTATION

Non-Indications

- ✓ Permanent pacemaker implantation is **not** indicated in any of the following settings:
- Sinus node dysfunction in asymptomatic patients
 - Sinus node dysfunction in patients for whom the symptoms, suggestive of bradycardia, have been clearly documented to occur in the absence of bradycardia
 - Fascicular block without AV block or symptoms concerning for AV block
 - Incidentally noted hypersensitive cardioinhibitory response to carotid sinus stimulation without symptoms or with vague symptoms

Reference:

- *Circulation* 2008;117:e350-408

- Asymptomatic first degree AV block

References:

- *PACE* 1996;19:747-51
- *N Engl J Med* 1986;315:1183-7

- 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

References:

- *Circulation* 1981;63:1043-9
- *Circulation* 1974;49:638-46

- Permanent ventricular pacing not indicated for asymptomatic transient AV block in the absence of intraventricular conduction defects or in isolated single fascicular block.

References:

- *Circulation* 2008;117:e350-408
- *Circulation* 1979;60:1455-64

- Permanent pacing not indicated for situational vasovagal syncope in which avoidance behavior is effective.

References:

- *Circulation* 2008;117:e350-408
- *JAMA* 2003;289:2224-9

CARDIAC RHYTHM IMPLANTABLE DEVICE (CRID) GUIDELINES

CARDIAC RHYTHM IMPLANTABLE DEVICE (CRID) GUIDELINE REFERENCES

CRID-2.1 Survivors of Cardiac Arrest Due to VT or VF

- AVID: Josephson, Mark E, MD, Nisam, Seah. The AVID Trial Executive Committee. Are Implantable Cardioverter-Defibrillators or Drugs More Effective in Prolonging Life? *American Journal of Cardiology*. 1997;79:661-663.
- CASH: Kuck K, Cappato R, Siebels J, et al. Randomized Comparison of Antiarrhythmic Drug Therapy with Implantable Defibrillators in Patients Resuscitated from Cardiac Arrest: The Cardiac Arrest Study Hamburg. 2000;102:748-754.
- CIDS: Connolly, Stuart j., MD, FRCPC et al. Canadian Implantable Defibrillator Study (CIDS). A Randomized Trial of the Implantable Cardioverter Defibrillator Against Amiodarone. *American Heart Association Journal*; 2000;101:1297-1302.

CRID-2.2 Structural Heart Disease with Sustained VT VF

- AVID: Josephson, Mark E, MD, Nisam, Seah. The AVID Trial Executive Committee. Are Implantable Cardioverter-Defibrillators or Drugs More Effective in Prolonging Life? *American Journal of Cardiology*. 1997;79:661-663.
- CASH: Kuck K, Cappato R, Siebels J, et al. Randomized Comparison of Antiarrhythmic Drug Therapy with Implantable Defibrillators in Patients Resuscitated from Cardiac Arrest: The Cardiac Arrest Study Hamburg. 2000;102:748-754.
- CIDS: Connolly, Stuart j., MD, FRCPC et al. Canadian Implantable Defibrillator Study (CIDS). A Randomized Trial of the Implantable Cardioverter Defibrillator Against Amiodarone. *American Heart Association Journal*; 2000;101:1297-1302.

CRID-2.3 Syncope of Undetermined Origin and Positive Electrophysiology Study

- Expert consensus reported in ACC/AHA/HRS Guidelines: Epstein et al. *AHA Journal*, 2008, pg. e378, section 3.1.8.

CRID-2.4 Unexplained Syncope

- Expert consensus reported in ACC/AHA/HRS Guidelines: Epstein et al. *AHA Journal*, 2008,pg.e384. Class IIa, 2.

CRID-2.5 Ischemic Cardiomyopathy

- DINAMIT: Gerian Gronefeld, Stuart J. Connolly and Stefan H. Hohnloser. The Defibrillator in Acute Myocardial Infarction Trial (DINAMIT): Rationale, Design and Specific Aims. *Cardiac Electrophysiology Review*, Volume 7, Number 4, 447-451.
- IRIS: Steinbeck G, Andresen D, Seidl K, et al. Defibrillator implantation early after myocardial infarction. *N Engl J Med* 2009; 361:1427-1436.
- MADIT2: Moss AJ, Hall WJ, Cannom DS, et al. Cardiac-resynchronization therapy for the prevention of heart-failure events. *N Engl J Med* 2009;361:1329-38.
- SCD-HeFT: 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.

CRID-2.6 Nonischemic Dilated Cardiomyopathy (DCM)

- Expert consensus reported in ACC/AHA/HRS guidelines and non-randomized trials of ICD implantation in HCM patients: Epstein et al. *AHA Journal*, 2008, pg. e384. Class IIa, 3.
<http://circ.ahajournals.org/cgi/content/full/117/21/e350>, accessed January 16, 2012.
- DINAMIT: Gerian Gronefeld, Stuart J. Connolly and Stefan H. Hohnloser. The Defibrillator in Acute Myocardial Infarction Trial (DINAMIT): Rationale, Design and Specific Aims. *Cardiac Electrophysiology Review*, Volume 7, Number 4, 447-451.

- IRIS: Steinbeck G, Andresen D, Seidl K, et al. Defibrillator implantation early after myocardial infarction. *N Engl J Med* 2009; 361:1427-1436.
- MADIT2: Moss AJ, Hall WJ, Cannom DS, et al. Cardiac-resynchronization therapy for the prevention of heart-failure events. *N Engl J Med* 2009;361:1329-38.
- MUSTT: Buxton AE, Lee KL, DiCarlo L, et al. Electrophysiologic testing to identify patients with coronary artery disease who are at risk for sudden death. Multicenter Unsustained Tachycardia Trial Investigators. *N Engl J Med* 2000;342:1937-45.

CRID-3.2 Sustained Ventricular Tachycardia (VT) with Normal LV Function

- Expert consensus reported in ACC/AHA/HRS guidelines and non-randomized trials of ICD implantation in HCM patients: Epstein et al. *AHA Journal*, 2008, pg. e384. Class IIa, 3.

CRID-3.3 Cardiomyopathy due to Hypertrophic Cardiomyopathy or

✓ Arrhythmogenic Right Ventricular Cardiomyopathy (ARVC)

- Expert consensus reported in ACC/AHA/HRS guidelines and non-randomized trials of ICD implantation in HCM patients: Epstein et al. *AHA Journal*, 2008, pg. e384. Class IIa, 3,4.

CRID-3.4 Long QT Syndrome

- Expert consensus reported in ACC/AHA/HRS guidelines and non-randomized trials of ICD implantation in HCM patients: Epstein et al. *AHA Journal*, 2008, pg. e384. Class IIa, 5.

CRID-3.5 Brugada's Syndrome

- Expert consensus reported in ACC/AHA/HRS guidelines and non-randomized trials of ICD implantation in HCM patients: Epstein et al. *AHA Journal*, 2008, pg. e384. Class IIa, 7, 8.

CRID-3.6 Catecholaminergic Polymorphic Ventricular Tachycardia (VT)

- Expert consensus reported in ACC/AHA/HRS guidelines and non-randomized trials of ICD implantation in HCM patients: Epstein et al. *AHA Journal*, 2008, pg. e384. Class IIa, 9.

CRID-3.7 Other Indications

- Caliskan, et al. Prophylactic ICDs for Noncompaction Cardiomyopathy. *Journal of Cardiovascular Electrophysiology*. Vol. 22, pp. 898-904, August 2011.
- Expert consensus reported in ACC/AHA/HRS guidelines and non-randomized trials of ICD implantation in HCM patients: Epstein et al. *AHA Journal*, 2008, pg. e384. Class IIa, 10.

CRID-3.8 Familial Cardiomyopathy

- Expert consensus reported in ACC/AHA/HRS guidelines and non-randomized trials of ICD implantation in HCM patients: Epstein et al. *AHA Journal*, 2008, pg. e384. Class IIb, 4.

CRID-4 ~ ICD IMPLANTATION—NON-INDICATIONS

See References listed in **CRID-2**

CRID-5.1 Dilated Cardiomyopathy with NYHA Class III or IV Congestive Heart Failure (CHF)

- COMPANION: Bristow MR, Saxon LA, Boehmer J, et al. Cardiac-resynchronization therapy with or without an implantable defibrillator in advanced chronic heart failure. *N Engl J Med* 2004;350:2140-50.

CRID-5.2 Dilated Cardiomyopathy-NYHA Class II Congestive Heart Failure (CHF)

- Blue Cross Blue Shield. Cardiac Resynchronization Therapy for Mild Heart Failure. Technology Evaluation Center (TEC) CRT, July, 2011. *BCBSA TEC July 2011*; 26(1):1-28.
- MADIT-CRT: Zareba et al. Effectiveness of Cardiac Resynchronization Therapy by QRS Morphology in Multicenter Automatic Defibrillator Implantation Trial – Cardiac Resynchronization Therapy (MADIT-CRT). *Circulation* March 15, 2011. 1061-1072.
- RAFT: Tang et al. Cardiac-Resynchronization Therapy for Mil-to-Moderate Heart Failure. *NEJM*, December 16, 2010, Volume 363, number 25. Pgs. 2385-2395.
- REVERSE: Linde C, Gold MR, Abraham WT, Daubert J-C, for the REVERSE Study Group. *American Heart Journal*. 2006; 151: 288-294.

- SCD-HeFT: 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.

CRID-6~(CRT)-D IMPLANTATION—NON-INDICATIONS:

- (See References listed in **CRID-5**)

CRID-7.1 Symptomatic Bradycardia

- Epstein AE, DiMarco JP, Ellenbogen KA, et al. 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): developed in collaboration with the American Association for Thoracic Surgery and Society of Thoracic Surgeons. *Circulation* 2008;117:e350-408.
- Kay R, Estioko M, Wiener I. Primary sick sinus syndrome as an indication for chronic pacemaker therapy in young adults: incidence, clinical features, and long-term evaluation. *Am Heart J* 1982;103:338-42.
- Kusumoto FM, Goldschlager N. Cardiac pacing. *N Engl J Med* 1996;334:89-97.
- Rasmussen K. Chronic sinus node disease: natural course and indications for pacing. *European Heart Journal* 1981;2:455-9.
- Recommendations for pacemaker prescription for symptomatic bradycardia. Report of a working party of the British Pacing and Electrophysiology Group. *British Heart Journal* 1991;66:185-91.

CRID-7.2 Symptomatic Chronotropic Incompetence

- Linde-Edelstam C, Nordlander R, Pehrsson SK, Ryden L. A double-blind study of submaximal exercise tolerance and variation in paced rate in atrial synchronous compared to activity sensor modulated ventricular pacing. *PACE* 1992;15:905-15.

CRID-7.3 Indications for Asymptomatic Patients

- Charles R, Holt S, Kay JM, Epstein EJ, Rees JR. Myocardial ultrastructure and the development of atrioventricular block in Kearns-Sayre syndrome. *Circulation* 1981;63:214-9.
- Clemmensen P, Bates ER, Califf RM, et al. Complete atrioventricular block complicating inferior wall acute myocardial infarction treated with reperfusion therapy. TAMI Study Group. *Am J Cardiol* 1991;67:225-30.
- Ector H, Rolies L, De Geest H. Dynamic electrocardiography and ventricular pauses of 3 seconds and more: etiology and therapeutic implications. *PACE* 1983;6:548-51.
- Epstein AE, DiMarco JP, Ellenbogen KA, et al. 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): developed in collaboration with the American Association for Thoracic Surgery and Society of Thoracic Surgeons. *Circulation* 2008;117:e350-408.
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- Hiromasa S, Ikeda T, Kubota K, et al. Myotonic dystrophy: ambulatory electrocardiogram, electrophysiologic study, and echocardiographic evaluation. *Am Heart J* 1987;113:1482-8.
- James TN, Fisch C. Observations on the Cardiovascular Involvement in Friedreich's Ataxia. *Am Heart J* 1963;66:164-75.
- Kastor JA. Atrioventricular block (first of two parts). *N Engl J Med* 1975;292:462-5.
- Kastor JA. Atrioventricular block (second of two parts). *N Engl J Med* 1975;292:572-4.
- Perloff JK, Stevenson WG, Roberts NK, Cabeen W, Weiss J. Cardiac involvement in myotonic muscular dystrophy (Steinert's disease): a prospective study of 25 patients. *Am J Cardiol* 1984;54:1074-81.

- Recommendations for pacemaker prescription for symptomatic bradycardia. Report of a working party of the British Pacing and Electrophysiology Group. *British Heart Journal* 1991;66:185-91.
- Ritter WS, Atkins JM, Blomqvist CG, Mullins CB. Permanent pacing in patients with transient trifascicular block during acute myocardial infarction. *Am J Cardiol* 1976;38:205-8.
- Roberts NK, Perloff JK, Kark RA. Cardiac conduction in the Kearns-Sayre syndrome (a neuromuscular disorder associated with progressive external ophthalmoplegia and pigmentary retinopathy). Report of 2 cases and review of 17 published cases. *Am J Cardiol* 1979;44:1396-400.
- Stevenson WG, Perloff JK, Weiss JN, Anderson TL. Facioscapulohumeral muscular dystrophy: evidence for selective, genetic electrophysiologic cardiac involvement. *J Am Coll Cardiol* 1990;15:292-9.
- Strasberg B, Amat YLF, Dhingra RC, et al. Natural history of chronic second-degree atrioventricular nodal block. *Circulation* 1981;63:1043-9.
- Zipes DP. Second-degree atrioventricular block. *Circulation* 1979;60:465-72.

CRID-7.4 Prior to Planned Catheter Ablation

- Langberg JJ, Chin MC, Rosenqvist M, et al. Catheter ablation of the atrioventricular junction with radiofrequency energy. *Circulation* 1989;80:1527-35.

CRID-7.5 Persistent Second Degree AV Block

- Clemmensen P, Bates ER, Califf RM, et al. Complete atrioventricular block complicating inferior wall acute myocardial infarction treated with reperfusion therapy. TAMI Study Group. *Am J Cardiol* 1991;67:225-30.
- Col JJ, Weinberg SL. The incidence and mortality of intraventricular conduction defects in acute myocardial infarction. *Am J Cardiol* 1972;29:344-50.
- Lamas GA, Muller JE, Turi ZG, et al. A simplified method to predict occurrence of complete heart block during acute myocardial infarction. *Am J Cardiol* 1986;57:1213-9.

- Ritter WS, Atkins JM, Blomqvist CG, Mullins CB. Permanent pacing in patients with transient trifascicular block during acute myocardial infarction. *Am J Cardiol* 1976;38:205-8.

CRID-7.6 Syncope

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CRID-8.2 Sinus Node Dysfunction

- Kay R, Estioko M, Wiener I. Primary sick sinus syndrome as an indication for chronic pacemaker therapy in young adults: incidence, clinical features, and long-term evaluation. *Am Heart J* 1982;103:338-42.
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- Sheldon R, Koshman ML, Wilson W, Kieser T, Rose S. Effect of dual-chamber pacing with automatic rate-drop sensing on recurrent neurally mediated syncope. *Am J Cardiol* 1998;81:158-62.

CRID-8.4 Asymptomatic Second Degree AV Block

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- Zipes DP. Second-degree atrioventricular block. *Circulation* 1979;60:465-72.

CRID-8.5 First or Second AV Block

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- Connelly DT, Steinhaus DM. Mobitz type I atrioventricular block: an indication for permanent pacing? *PACE* 1996;19:261-4.
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CRID-8.6 Symptomatic Recurrent SVT

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- Herre JM, Griffin JC, Nielsen AP, et al. Permanent triggered antitachycardia pacemakers in the management of recurrent sustained ventricular tachycardia. *J Am Coll Cardiol* 1985;6:206-14.
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CRID-8.7 Relative Bradycardia – Postoperative Cardiac Transplant

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CRID-8.8 Incidental Finding at Electrophysiology (EP) Study

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CRID-8.9 Neuromuscular Diseases Known to Involve the Heart

- Charles R, Holt S, Kay JM, Epstein EJ, Rees JR. Myocardial ultrastructure and the development of atrioventricular block in Kearns-Sayre syndrome. *Circulation* 1981;63:214-9.
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