SCA PREVENTION
PATHWAYS AND TOOLS

Sudden Cardiac Arrest (SCA) Prevention Treatment Algorithms

- Inpatient to Outpatient Transition
- ACE Inhibitors and/or ARBs
- Beta Blockers
- Aldosterone Antagonists
- Implantable Cardioverter Defibrillator Therapy (ICD Inpatient)
- Cardiac Resynchronization Therapy (CRT Inpatient)
- Anticoagulation Therapy in Patients with Atrial Fibrillation (Outpatient)
- Management of Volume Overload (Outpatient)
- Implantable Cardioverter Defibrillator (ICD Outpatient)
- Cardiac Resynchronization Therapy (CRT Outpatient)
- Device Therapy

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Sudden Cardiac Arrest (SCA) Prevention Pathways and Tools Objectives

- **Facilitate** optimal care for post-MI and HF patients at risk for SCA
- **Educate** healthcare providers and patients about SCA and treatment options and increase awareness and patient access to diagnostics and lifesaving therapies
- **Promote** evidence-based, guideline-recommended medical and device therapy and increase guideline awareness and adoption among healthcare providers
- **Assist** hospitals and practices in closing treatment gaps by providing practical information, disease management, and communication tools to identify and treat patients at risk for SCA

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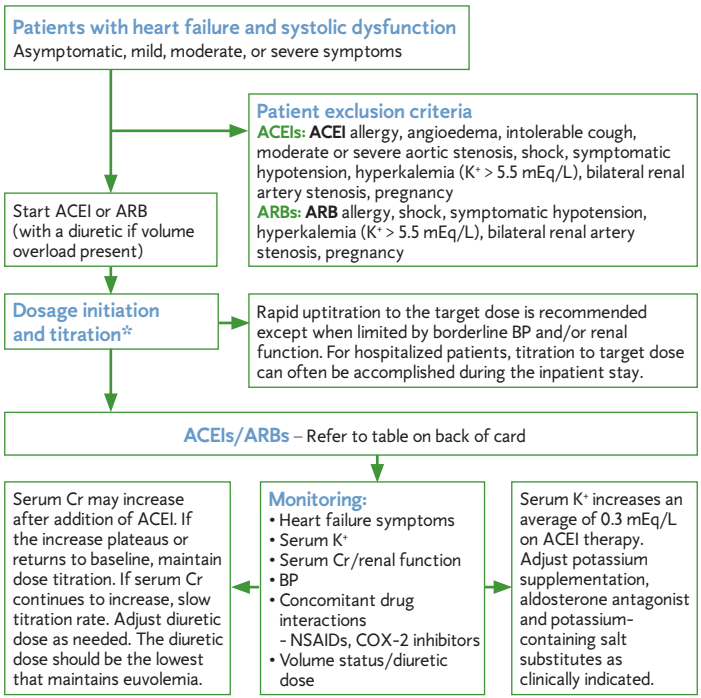
Angiotensin-Converting Enzyme Inhibitor (ACEI)/ Angiotensin Receptor Blocker (ARB) Inpatient/Outpatient Treatment Algorithm



Note: Careful consideration of patient characteristics and choice of drugs is warranted.

* For hospitalized patients previously treated with ACEI/ARB at the time of admission, therapy should be continued in the absence of contraindications.

	ACEIs							ARBs†	
	Captopril	Enalapril	Lisinopril	Ramipril	Trandolapril	Quinapril	Fosinopril	Candesartan	Valsartan
Initial dose	6.25 mg tid	2.5 mg bid	2.5–5 mg qd	2.5 mg qd	1 mg qd	10 mg qd	10 mg qd	4–8 mg qd	40 mg bid
Titration steps (typically double dose at each step)	12.5 mg tid 25 mg tid	5 mg bid	5 mg qd 10 mg qd	5 mg qd	2 mg qd	20 mg qd 40 mg qd	20 mg qd 40 mg qd	16 mg qd	80 mg bid
Target dose	50 mg tid	10 mg bid	20 mg qd	10 mg qd	4 mg qd	80 mg qd	80 mg qd	32 mg qd	160 mg bid

† ARBs are most frequently used in place of ACEIs when side effects limit ACEI use (intolerable cough may occur in as many as 20% of patients receiving ACEIs).

Routine combined use of an ACEI, ARB, and aldosterone antagonist is not recommended for patients with current or prior symptoms of HF and reduced LVEF.

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Beta Blocker Inpatient/Outpatient Treatment Algorithm

Patients with heart failure and systolic dysfunction
Asymptomatic, mild, moderate, or severe symptoms

Patient exclusion criteria:
- Cardiogenic shock
- Unstable or decompensated heart failure
- Symptomatic hypotension
- Symptomatic bradycardia without a pacemaker
- Heart block > 1st degree without a pacemaker
- Severe reactive airway disease

Initiation and titration[1,2]

Guideline Recommended Beta Blockers for HF[3]

	Carvedilol	Sustained-release metoprolol succinate	Bisoprolol
Initial dose	3.125 mg bid	12.5–25 mg qd	1.25 mg qd
Titration steps[5]	6.25 mg bid 12.5 mg bid	50 mg qd 100 mg qd 150 mg qd	2.5 mg qd 5 mg qd
Target dose[6]	25 mg bid[7]	200 mg qd	10 mg qd

If volume overload develops, continue BB unless[4]:
- Cardiogenic shock
- Systemic hypotension
- Narrow pulse pressure
- Cold, clammy skin
- Rising BUN/serum Cr

Patient Monitoring:
- Daily weight
- Symptoms of worsening heart failure
- BP, HR
- Diuretic dosage

Maintain diuretic at lowest dose necessary to maintain euvolemia.

If patient becomes orthostatic, reduce diuretic dose and/or stagger doses of ACEI/ARB and other medications that lower BP.

Outpatient Monitoring
Recommend that patients compile daily weight log and notify their MD if weight increases 3–5 lbs or more in 1 week.

Outpatient Monitoring
Patients should notify MD if they develop symptomatic hypotension and/or bradycardia.

References

[1] Beta blocker therapy initiation is recommended for patients with a recent decompensation of HF after optimization of volume status and successful discontinuation of IV diuretics and vasoactive agents, including inotropic support. Whenever possible, beta blockade should be initiated in the hospital setting at a low dose in stable patients prior to discharge.

[2] Patients hospitalized with decompensated HF already treated with beta blocker therapy prior to hospitalization should continue on beta blocker therapy as long as they do not have any contraindications, are not in cardiogenic shock, and do not show signs of systemic hypoperfusion (altered mental status, narrow pulse pressure, cold or clammy skin, rising BUN/serum Cr). A temporary reduction of dose in this setting may be considered. Abrupt discontinuation should be avoided, if possible. If discontinued or reduced, beta blockers should be reinstated or the dose should be gradually increased before the patient is discharged.

[3] ACC/AHA 2005 guidelines recommend using only those beta blockers proven to be effective in heart failure (carvedilol, sustained-release metoprolol succinate, and bisoprolol) at the doses studied in large clinical trials. If patient is currently on a beta blocker other than those listed, consider switching.

[4] Applies to both outpatients and those hospitalized for heart failure.

[5] Beta blocker titration steps are generally at 2-week intervals. BP and HR should be carefully monitored. If SBP is < 80 mmHg or HR is < 55 bpm, assess the dose and recheck patient carefully for signs of hypoperfusion. Recheck status as needed.

[6] Patients who cannot achieve target dose of the beta blocker should be maintained on the highest tolerated dose.

[7] For patients weighing > 85 kg, carvedilol 50 mg bid may be used.

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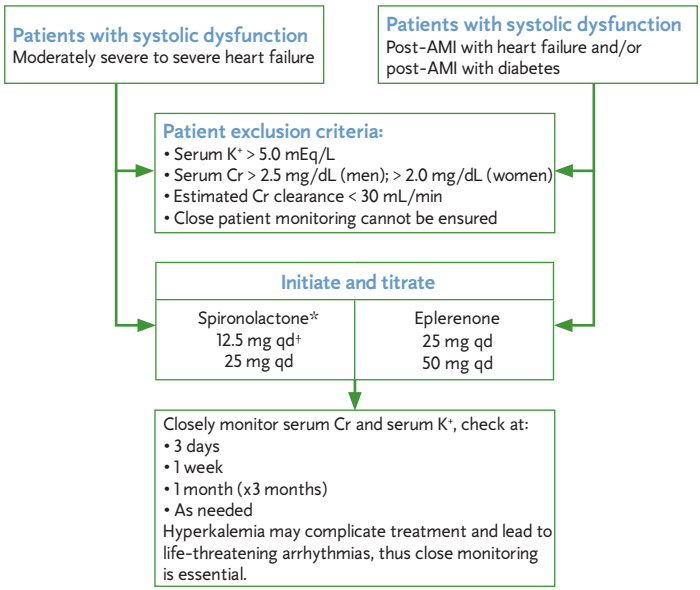
Aldosterone Antagonist Inpatient/Outpatient Treatment Algorithm



Routine combined use of an ACEI, ARB, and aldosterone antagonist is not recommended for patients with current or prior symptoms of heart failure and reduced LVEF.

* Switch to eplerenone if signs of gynecomastia.

† Start at 6.25 mg qd in patients at increased risk for hyperkalemia.

- Impaired renal function is a risk factor for hyperkalemia during treatment with aldosterone antagonists. The risk of hyperkalemia increases progressively when serum Cr > 1.6 mg/dL.
- Hyperkalemia risk is increased with concomitant use of higher doses of ACEIs or ARBs
- NSAIDs and COX-2 inhibitors should be avoided
- Potassium supplements should be discontinued or reduced
- Dehydration, by diarrhea or other causes, should be addressed emergently

Ongoing clinical trials are evaluating the benefit of aldosterone antagonists in patients with mild heart failure.

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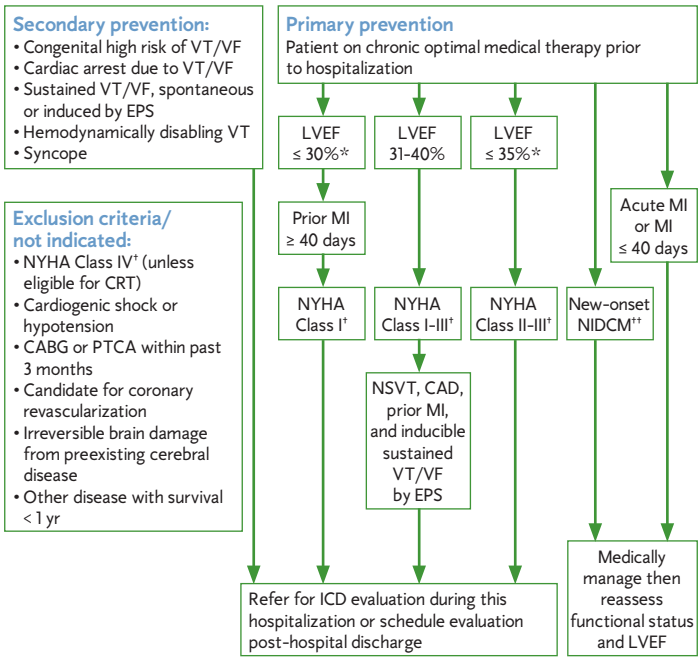
Implantable Cardioverter Defibrillator (ICD) Therapy Inpatient Algorithm



* Class I recommendation.

† Functional status as documented prior to current hospitalization while on chronic optimal medical therapy.

†† CMS coverage for primary prevention ICD implants: patients with nonischemic dilated cardiomyopathy (NIDCM) > 9 months, NYHA Class II and III heart failure, and measured LVEF ≤ 35%. Patients with NIDCM > 3 months and < 9 months, NYHA Class II or III heart failure, and measured LVEF ≤ 35% at this time are only covered by Medicare if these patients are enrolled in an FDA-approved category B IDE clinical trial, a trial under the CMS clinical trial policy, or the American College of Cardiology National Cardiovascular Data Registry (ACC-NCDR).

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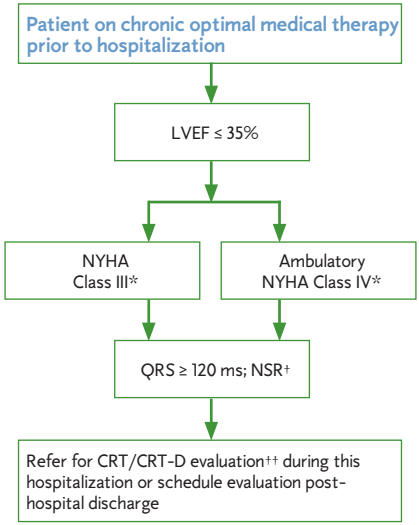
Cardiac Resynchronization Therapy (CRT) Inpatient Algorithm



Note: Ongoing clinical trials are evaluating the benefit of CRT in NYHA Class II patients.

* Functional status as documented prior to current hospitalization while on chronic optimal medical therapy.

† CRT is a Class I guideline recommendation for patients with normal sinus rhythm (NSR). CRT is a Class IIa recommendation for patients with atrial fibrillation. Preliminary data suggest a possible functional improvement in these patients.

†† Inclusion of defibrillator to be based on ICD algorithm and physician discretion.

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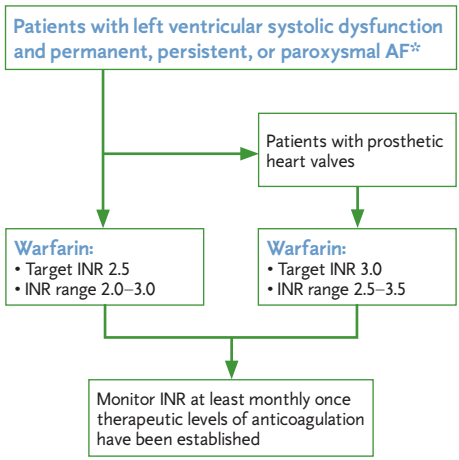
Anticoagulation Therapy in Atrial Fibrillation Outpatient Algorithm



*Atrial flutter should be similarly treated.

- Contraindications to warfarin include:
  - Allergy
  - Pregnancy
  - Risk of bleeding (such as active peptic ulcer disease); hemorrhagic stroke; other hemorrhage; hepatic failure; bleeding disorder; metastatic cancer; recent or planned surgery or biopsy procedure; other physician-documented bleeding risk
  - High risk of fall documented by physician
  - Psychosocial concerns (such as active psychosis; terminal illness/comfort care only; alcoholism or drug abuse)
  - Other potential contraindication (such as seizure disorder; malignant hypertension; intracranial aneurysm, repaired or unrepaired)
- Aspirin should be used in patients with absolute contraindications to oral anticoagulation

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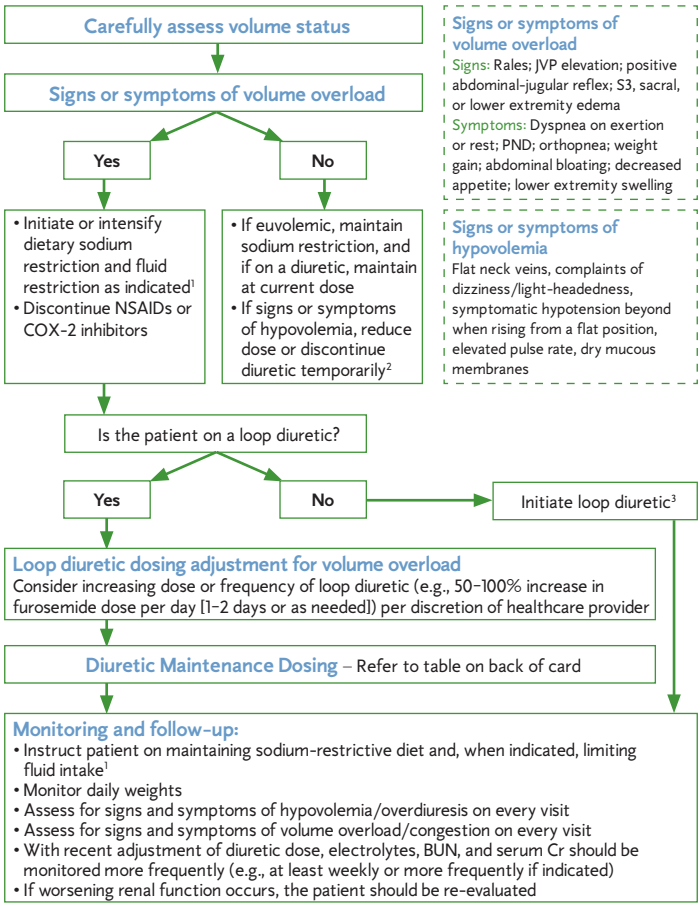
Management of Volume Overload Outpatient Algorithm



Diuretic Maintenance Dosing	
Weight returned to baseline (identifiable cause for weight increase, e.g., nonadherence)	Resume original dose
Weight returned to baseline, but patient failed original dose previously, or no known cause for weight gain	Continue at current increased dose
Weight returned to baseline, but required 2 or more diuretic titrations	Resume dose prior to last increase (i.e., down 1 titration level)
Symptoms improved, but weight has not returned to baseline	Continue at current increased dose
Persistent symptoms with no change in weight	Continue next titration level
Persistent or worsening symptoms, and/or increase in weight, and/or history of frequent hospitalizations for volume overload	Consider adding metolazone, IV diuretic, or hospitalization. PO metolazone may be added in resistant cases for no more than 3 days, then reassess[4]

References

[1] Fluid restriction (< 2 L/day) is recommended in patients with moderate hyponatremia (serum sodium < 130 mEq/L) and should be considered to assist in treatment of fluid overload in other patients.

[2] Consider also loosening the degree of dietary sodium restriction, then reassess.

[3] Initial dose of loop diuretic at physician discretion. Careful observation for the development of side effects, including electrolyte abnormalities, symptomatic hypotension, and renal dysfunction, is recommended in patients treated with diuretics. Patients should undergo routine laboratory studies and clinical examination as dictated by their clinical response.

[4] Addition of chlorothiazides or metolazone, once or twice daily, to loop diuretics should be considered in patients with persistent fluid retention despite high-dose loop diuretic therapy. But chronic daily use, especially of metolazone, should be avoided if possible because of the potential for electrolyte shifts and volume depletion. These drugs may be used periodically (every other day or weekly) to optimize fluid management. Volume status and electrolytes must be monitored closely when multiple diuretics are used. Consider administering metolazone 30–60 min before administration of loop diuretic.

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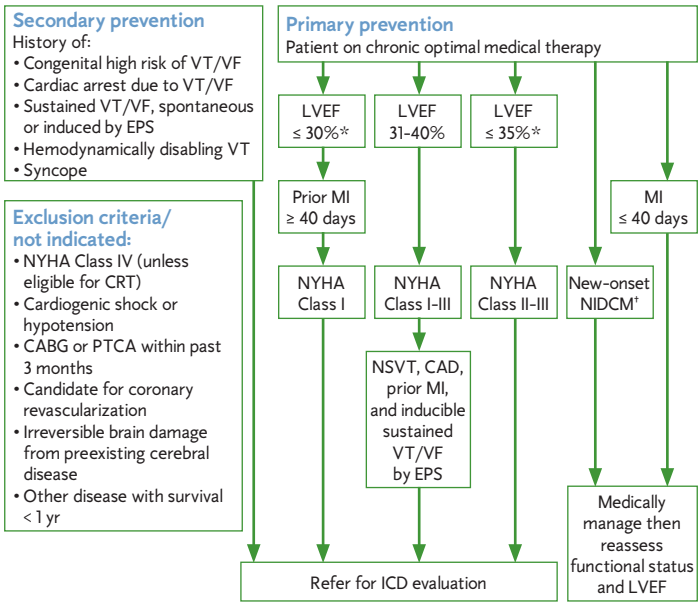
Implantable Cardioverter Defibrillator (ICD) Therapy Outpatient Algorithm



* Class I recommendation.

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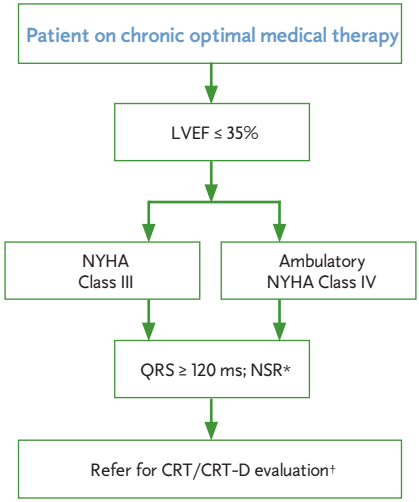
Cardiac Resynchronization Therapy (CRT) Outpatient Algorithm



Note: Ongoing clinical trials are evaluating the benefit of CRT in NYHA Class II patients.

* CRT is a Class I guideline recommendation for patients with normal sinus rhythm (NSR). CRT is a Class IIa recommendation for patients with atrial fibrillation. Preliminary data suggest a possible functional improvement in these patients.

† Inclusion of defibrillator to be based on ICD algorithm and physician discretion.

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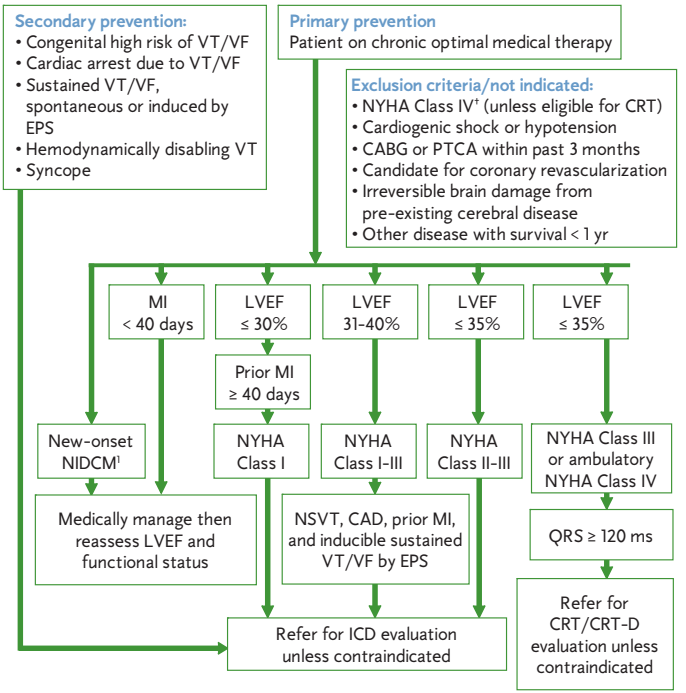
Device Therapy Algorithm



ICD therapy is not indicated for patients 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 specified in the algorithm. 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.

† Functional status as documented prior to current hospitalization while on chronic optimal medical therapy.

References

[1] CMS coverage for primary prevention ICD implants: patients with non-ischemic dilated cardiomyopathy (NIDCM) > 9 months, NYHA Class II and III heart failure, and measured LVEF ≤ 35%. Patients with NIDCM > 3 months and < 9 months, NYHA Class II or III heart failure, and measured LVEF ≤ 35% at this time are only covered by Medicare if these patients are enrolled in an FDA-approved category B IDE clinical trial, a trial under the CMS clinical trial policy, or the American College of Cardiology National Cardiovascular Data Registry (ACC-NCDR).

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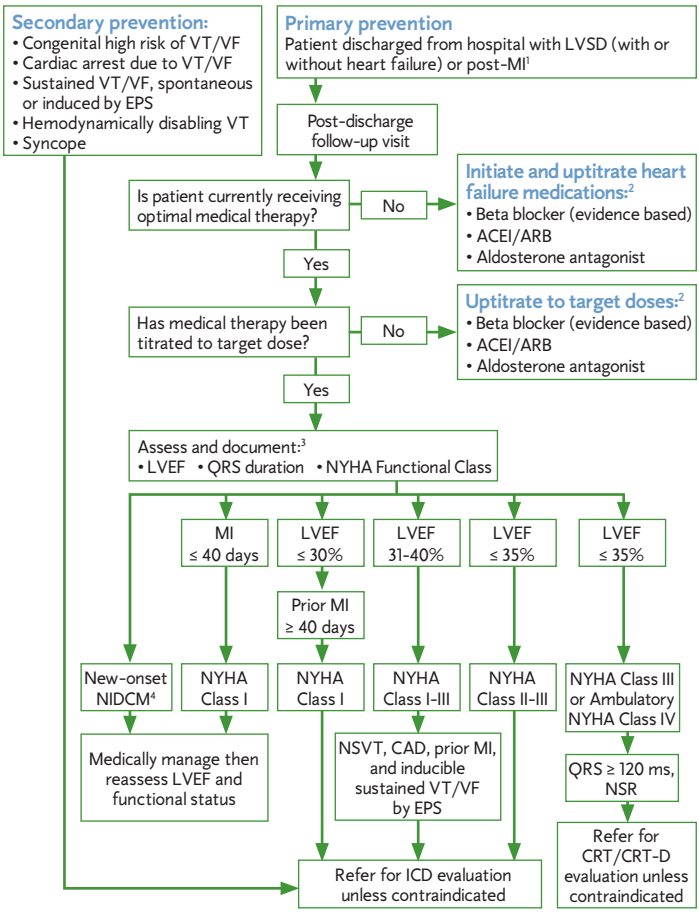
Inpatient to Outpatient Transition Algorithm for Medical and Device Therapy



References

[1] Patients with secondary indications for device therapy should undergo evaluation and device placement prior to hospital discharge.

[2] Please see individual medication and device algorithms for details.

[3] 3–6 months of optimal medical therapy is suggested before reassessment of LVEF and functional status.

[4] CMS coverage for primary prevention ICD implants: patients with non-ischemic dilated cardiomyopathy (NIDCM) > 9 months, NYHA Class II and III heart failure, and measured LVEF ≤ 35%. Patients with NIDCM > 3 months and < 9 months, NYHA Class II or III heart failure, and measured LVEF ≤ 35% at this time are only covered by Medicare if these patients are enrolled in an FDA-approved category B IDE clinical trial, a trial under the CMS clinical trial policy, or the American College of Cardiology National Cardiovascular Data Registry (ACC-NCDR).

Reference Source

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Guideline Recommendations for Heart Failure Device Therapy

Summary of recommendations for the use of ICD and/or CRT from the *2005 ACC/AHA Guideline Update for the Diagnosis and Management of Chronic Heart Failure in the Adult*[1] and the *2008 ACC/AHA/HRS Guidelines for Device-Based Therapy for Cardiac Rhythm Abnormalities*[2]

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

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

Guideline Recommendations Patients with Current or Prior Symptoms of HF (Stage C) Patients with Reduced LVEF Recommendations for ICD Therapy	
Class I Level of Evidence A	An ICD 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

Class I Level of Evidence A	ICD therapy is recommended for primary prevention to reduce total mortality by a reduction in sudden cardiac death in patients with ischemic heart disease who are at least 40 days post-MI, have an LVEF ≤ 30% with NYHA Class I symptoms or an LVEF ≤ 35% with NYHA Class II/III symptoms while undergoing chronic medical therapy and have a reasonable expectation of survival with a good functional status for more than 1 year
Class I Level of Evidence B	ICD therapy is recommended for primary prevention to reduce total mortality by a reduction in sudden cardiac death in patients with non-ischemic cardiomyopathy who have an LVEF ≤ 35%, with NYHA Class II or III symptoms while undergoing chronic medical therapy and have a reasonable expectation of survival with a good functional status for more than 1 year
Class IIb Level of Evidence C	ICD therapy may be considered in patients with nonischemic heart disease who have an LVEF ≤ 35% with NYHA Class I symptoms

Guideline Recommendations Patients with Current or Prior Symptoms of HF (Stage C) Patients with Reduced LVEF Recommendations for CRT Therapy*	
Class I Level of Evidence A	Patients with an LVEF ≤ 35%, sinus rhythm, and NYHA Class III or ambulatory Class IV symptoms despite recommended, optimal medical therapy and who have cardiac dyssynchrony, which is currently defined as a QRS duration > 120 ms, should receive cardiac resynchronization therapy unless contraindicated
Class IIa Levell of Evidence B	For patients with an LVEF ≤ 35%, a QRS duration of ≥ 120 ms, and AF, cardiac resynchronization therapy, with or without ICD therapy, is reasonable for the treatment of NYHA Class III or ambulatory Class IV symptoms on recommended optimal medical therapy
Class IIa Levell of Evidence C	For patients with an LVEF ≤ 35%, with NYHA Class III or ambulatory Class IV symptoms, who are receiving recommended optimal medical therapy and who have frequent dependence on ventricular pacing, cardiac resynchronization therapy is reasonable

*Inclusion of an ICD to be based on ICD recommendations and physician discretion.

References

[1] Hunt SA, Abraham WT, Chin MH, et al. ACC/AHA 2005 Guideline Update for the Diagnosis and Management of Chronic Heart Failure in the Adult: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to Update the 2001 Guidelines for the Evaluation and Management of Heart Failure). *Circulation.* September 20, 2005;112(12):e154-235.

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