

Table 1. Primary prevention of Heart Failure.

ESC 2026 GL on HF.

Recommendations for prevention of heart failure

Strict blood pressure control (systolic blood pressure target <130 mmHg) is recommended in patients with hypertension or stage B HF to reduce the risk of HF. ^{63–69,102}	I	A
An SGLT2-I is recommended in patients with T2DM at risk of HF (multiple ASCVD risk factors or established ASCVD) to reduce the risk of HF and CV death. ¹⁰³	I	A
An SGLT2-I is recommended in patients with T2DM and CKD ^c to reduce the risk of HF or CV death. ¹⁰⁴	I	A
Finerenone is recommended in patients with T2DM and CKD ^d to reduce the risk of HF. ^{105–108}	I	A
Counselling on healthy lifestyle choices including maintaining a healthy weight, consuming a well-balanced diet, avoiding sedentary behaviour, abstaining from smoking and heavy alcohol consumption as well as counselling against the use of drugs such as cocaine, amphetamines, and anabolic steroids is recommended for all patients with stage A or B HF to reduce the risk of HF progression. ^{74,84,85,87,91,95–100,109–112}	I	C
Treatment with a statin should be considered in people at high risk of, or with established ASCVD, to reduce the risk of HF. ⁷⁵	IIa	A
A GLP-1 RA should be considered in patients with T2DM and at least one other additional CV risk factor to reduce the risk of HF or CV death. ^{71,113,114}	IIa	A

ASCVD, atherosclerotic cardiovascular disease; CKD, chronic kidney disease; CV, cardiovascular; eGFR, estimated glomerular filtration rate; GLP-1 RA, glucagon-like peptide-1 receptor agonist; HF, heart failure; SGLT2-I, sodium–glucose co-transporter 2 inhibitor; T2DM, type 2 diabetes mellitus.

cCKD was defined as follows: an eGFR 25–75 mL/min/1.73 m² and a urinary albumin-to-creatinine ratio ≥200–5000 mg/g in DAPA-CKD; an eGFR 20–45 mL/min/1.73 m² or an eGFR 45–90 mL/min/1.73 m² with a urinary albumin-to-creatinine ratio ≥200 mg/g in EMPA-KIDNEY; and eGFR 30–<90 mL/min/1.73 m² with a urinary albumin-to-creatinine ratio >300 to ≤5000 mg/g in CREDENCE.

dCKD was defined as follows: an eGFR 25–60 mL/min/1.73 m², a urinary albumin-to-creatinine ratio 30–300 mg/g, and diabetic retinopathy, or an eGFR 25–75 mL/min/1.73 m² and a urinary albumin-to-creatinine ratio 300–5000 mg/g, in FIDELIO-DKD¹; and an eGFR 25–90 mL/min/1.73 m² and a urinary albumin-to-creatinine ratio 30 to <300 mg/g, or an eGFR >60 mL/min/1.73 m² and a urinary albumin-to-creatinine ratio 300–5000 mg/g, in FIGARO-DKD¹⁰⁷.

Recommendations for stage B heart failure and left ventricular dysfunction

An ACE-I or ARB (if intolerant to ACE-I) is recommended in patients with stage B HF and LVEF $\leq 40\%$ to reduce the risk of HFH and death. ^{135-138,144}	I	A
A beta-blocker is recommended in patients with stage B HF and LVEF $< 50\%$ to reduce the risk of HFH or death. ^{35,139,140}	I	B1
Eplerenone is recommended in patients with LVEF $\leq 40\%$ after myocardial infarction with signs of HF or diabetes to reduce the risk of HFH and death. ¹⁴³	I	B1

ACE-I, angiotensin-converting enzyme inhibitor; ARB, angiotensin II receptor blocker; HF, heart failure; HFH, heart failure hospitalization; LVEF, left ventricular ejection fraction.

Table 2. ACC/AHA/HFSA 2022 GL on HF. STAGE A (PATIENTS AT RISK FOR HF)

Patients at Risk for HF (Stage A: Primary Prevention)

Control blood pressure in accordance with GDMT for hypertension to prevent symptomatic HF.	I A
In patients with type 2 diabetes and either established CVD or at high cardiovascular risk, SGLT2i to prevent hospitalizations for HF.	I A
In the general population, healthy lifestyle habits such as regular physical activity, maintain normal weight, healthy dietary patterns, and avoiding smoking to reduce future risk of HF.	I B-NR
For patients at risk of developing HF, natriuretic peptide biomarker-based screening followed by team-based care, including a cardiovascular specialist optimizing GDMT, to prevent the development of LV dysfunction (systolic or diastolic) or new-onset HF.	IIa B-R
In the general population, validated multivariable risk scores can be useful to estimate subsequent risk of incident.	IIa B-NR

AHA/ACC 2025 GL on hypertension. Prevention of HF in Adults With Hypertension

1	B-R	1. In adults with hypertension, treating SBP to <130 mm Hg is recommended to lower the risk of developing HF. ¹⁻⁴
1	B-NR	2. In adults with hypertension, treating DBP to <80 mm Hg is recommended to lower the risk of developing HF. ¹⁻⁵

Table 3. ACC/AHA/HFSA 2022 GL on HF. STAGE B (PATIENTS WITH PRE-HF)

Preventing the Syndrome of Clinical HF in Patients With Pre-HF

In patients with LVEF $\leq 40\%$, ACEi to prevent symptomatic HF and reduce mortality.	I A
In patients with a recent or remote history of MI or ACS, statins to prevent symptomatic HF and adverse cardiovascular events.	I A
In patients with a recent MI and LVEF $\leq 40\%$ who are intolerant to ACEi, ARB to prevent symptomatic HF and reduce mortality.	I B-R
In patients with a recent or remote history of MI or ACS and LVEF $\leq 40\%$, evidence-based beta blockers to reduce mortality.	I B-R
In patients who are at least 40 days post-MI with LVEF $\leq 30\%$ and NYHA class I symptoms while receiving GDMT and have reasonable expectation of meaningful survival for >1 year, an ICD for primary prevention of sudden cardiac death (SCD) to reduce total mortality.	I B-R
In patients with LVEF $\leq 40\%$, beta blockers to prevent symptomatic HF.	I C-LD
In patients with LVEF <50%, thiazolidinediones should not be used because they increase the risk of HF, including hospitalizations.	III B-R Harm
In patients with LVEF <50%, nondihydropyridine calcium channel blockers with negative inotropic effects may be harmful.	III B-R Harm

Table 4. ACC/AHA/HFSA 2022 GL on HF. STAGE C HF

Nonpharmacological Interventions: Self-Care Support in HF

Care from multidisciplinary teams to facilitate the implementation of GDMT, address potential barriers to self-care, reduce the risk of subsequent rehospitalization for HF, and improve survival.	I A
Specific education and support to facilitate HF self-care in a multidisciplinary manner.	I B-R
Vaccinating against respiratory illnesses to reduce mortality.	IIa B-NR
Screening for depression, social isolation, frailty, and low health literacy as risk factors for poor self-care to improve management.	IIa B-NR

Dietary Sodium Restriction

For patients with stage C HF, avoid excessive sodium intake to reduce congestive symptoms.	IIa C-LD
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Activity, Exercise Prescription, and Cardiac Rehabilitation

For patients who are able to participate, exercise training (or regular physical activity) to improve functional status, exercise performance, and QOL.	I A
A cardiac rehabilitation program to improve functional capacity, exercise tolerance, and health-related QOL.	IIa B-NR

Diuretics and Decongestion Strategies in Patients With HF

In patients with fluid retention, diuretics to relieve congestion, improve symptoms, and prevent worsening HF.	I B-NR
For patients with congestive symptoms, addition of a thiazide (eg, metolazone) to treatment with a loop diuretic should be reserved for patients who do not respond to moderate or high-dose loop diuretics to minimize electrolyte abnormalities.	I B-NR

Commonly Used Oral Diuretics in Treatment of Congestion for Chronic HF

Drug	Initial Daily Dose	Maximum Total Daily Dose	Duration of Action
Loop diuretics			
Bumetanide	0.5–1.0 mg once or twice	10 mg	4–6 h
Furosemide	20–40 mg once or twice	600 mg	6–8 h
Torsemide	10–20 mg once	200 mg	12–16 h
Thiazide diuretics			
Chlorthalidate	250–500 mg once or twice	1000 mg	6–12 h
Chlorthalidone	12.5–25 mg once	100 mg	24–72 h
Hydrochlorothiazide	25 mg once or twice	200 mg	6–12 h
Indapamide	2.5 mg once	5 mg	36 h
Metolazone	2.5 mg once	20 mg	12–24 h

Table 5. ACC/AHA/HFSA 2022 GL on HF. STAGE C HF. Potential Barriers to Effective HF Self-Care and Example Interventions

Potential Barrier	Example Screening Tools	Example Interventions
Medical Barriers		
Cognitive impairment ^{48–50}	Mini-Cog Mini-Mental State Examination (MMSE) Montreal Cognitive Assessment (MoCA)	Home health aide Home meal deliveries Adult day care Geriatric psychiatry referral Memory care support groups
Depression ^{51,52}	Hamilton Depression Rating Scale (HAM-D) Beck Depression Inventory-II (BDI-II) Patient Health Questionnaire-9 (PHQ-9)	Psychotherapy Selective serotonin reuptake inhibitors Nurse-led support
Substance use disorders ⁵³	Tobacco, Alcohol, Prescription medication, and other Substance use (TAPS)	Referral to social work services and community support partners Referral for addiction psychiatry consultation
Frailty ⁵⁴	Fried frailty phenotype	Cardiac rehabilitation Registered dietitian nutritionist evaluation for malnutrition
Social Barriers		
Financial burden of HF treatments ⁵⁵	COmprehensive Score for financial Toxicity–Functional Assessment of Chronic Illness Therapy (COST-FACIT)	PharmD referral to review prescription assistance eligibilities
Food insecurity ^{56,57}	Hunger Vital Sign, 2 items US Household Food Security Survey Module, 6 items	Determine eligibility for the Supplemental Nutrition Assistance Program (SNAP) Connect patients with community partners such as food pantries/food banks Home meal deliveries Registered dietitian nutritionist evaluation for potential malnutrition
Homelessness or housing insecurity ^{58–60}	Homelessness Screening Clinical Reminder (HSCR)	Referral to local housing services Connect patients with community housing partners
Intimate partner violence or elder abuse ^{61,62}	Humiliation, Afraid, Rape, Kick (HARK) questionnaire Partner Violence Screen (PVS) Woman Abuse Screening Tool (WAST)	Referral to social work services and community support partners
Limited English proficiency or other language barriers ⁶³	Routinely inquire in which language the patient is most comfortable conversing	Access to interpreter services covering a wide range of languages, ideally in person or, alternatively, via video platform Printed educational materials in a range of appropriate languages
Low health literacy ⁶⁴	Short Assessment of Health Literacy (SAHL) Rapid Estimate of Adult Literacy in Medicine–Short Form (REALM-SF) Brief Health Literacy Screen (BHLS), 3 items	Agency for Healthcare Research and Quality (AHRQ) Health Literacy Universal Precautions Toolkit Written education tools provided at sixth grade reading level or below Graphic educational documents
Social isolation or low social support ⁶⁵	Patient-Reported Outcomes Measurement Information System (PROMIS) Social Isolation Short Form	Determine eligibility for home care services Support group referral
Transport limitations	No validated tools currently available.	Referral to social work services Determine eligibility for insurance or state-based transportation, or reduced-cost public transportation Maximize opportunities for telehealth visits and remote monitoring

Table 6. ESC 2026 GL on HF. Evidence-based doses of disease-modifying drugs in key randomized trials in patients with heart failure

Drug	Starting dose	Target dose
ACE-Is		
Captopril ^a	6.25 mg t.i.d.	50 mg t.i.d.
Enalapril	2.5 mg b.i.d.	10–20 mg b.i.d.
Lisinopril ^b	2.5–5 mg o.d.	20–35 mg o.d.
Ramipril	1.25–2.5 mg b.i.d.	5 mg b.i.d.
Trandolapril ^a	0.5 mg o.d.	4 mg o.d.
ARNIs		
Sacubitril–valsartan	49/51 mg b.i.d. ^c	97/103 mg b.i.d.
ARBs		
Candesartan	4 mg o.d.	32 mg o.d.
Losartan	(12.5) 25–50 mg o.d.	150 mg o.d.
Valsartan	40 mg b.i.d.	160 mg b.i.d.
Beta-blockers		
Bisoprolol	1.25 mg o.d.	10 mg o.d.
Carvedilol	3.125 mg b.i.d.	25 mg b.i.d. ^d
Metoprolol succinate (CR/XL)	12.5–25 mg o.d.	200 mg o.d.
Nebivolol ^e	1.25 mg o.d.	10 mg o.d.
MRAs		
<i>Steroidal</i>		
Eplerenone	25 mg o.d.	50 mg o.d.
Spironolactone	12.5–25 mg o.d. ^f	50 mg o.d.
<i>Non-steroidal</i>		
Finerenone	10–20 mg o.d. ^g	20–40 mg o.d. ^g
SGLT2-Is		
Dapagliflozin	10 mg o.d.	10 mg o.d.
Empagliflozin	10 mg o.d.	10 mg o.d.
Other agents		
Digoxin ^h	62.5 µg o.d.	250 µg o.d.
Digitoxin ^h	0.07 mg o.d.	0.1 mg o.d.
Ivabradine	5 mg b.i.d.	7.5 mg b.i.d.
Vericiguat	2.5 mg o.d.	10 mg o.d.
Hydralazine/isosorbide dinitrate	37.5 mg t.i.d./20 mg t.i.d.	75 mg t.i.d./40 mg t.i.d.

The table provides initiation and target doses of FMT and AMT. For practical guidance in use of the different drugs, see [Supplementary data online, Tables S4–S9](#).

ACE-I, angiotensin-converting enzyme inhibitor; AMT, additional medical therapy; ARB, angiotensin II receptor blocker; ARNI, angiotensin receptor–neprilysin inhibitor; b.i.d., bis in die (twice daily); CR, controlled release; CV, cardiovascular; eGFR, estimated glomerular filtration rate; FMT, foundational medical therapy; MI, myocardial infarction; MRA, mineralocorticoid receptor antagonist; o.d., omne in die (once daily); SGLT2-I, sodium–glucose co-transporter 2 inhibitor; t.i.d., ter in die (three times a day); XL, extended release.

^aIndicates an ACE-I where the dosing target is derived from post-MI trials.

^bIndicates drugs where a higher dose has been shown to reduce morbidity/mortality compared with a lower dose of the same drug, but there is no substantive randomized, placebo-controlled trial and the optimal dose is uncertain.

^cSacubitril–valsartan may have an optional lower starting dose of 24/26 mg twice daily for those with a history of symptomatic hypotension, ACE-I naïve patients and patients with eGFR 30–60 mL/min/1.73 m².

^dA maximum dose of 50 mg twice daily can be administered to patients weighing over 85 kg.

^eIndicates a treatment not shown to reduce CV or all-cause death in patients with heart failure (or shown to be non-inferior to a treatment that does).

^fSpironolactone has an optional starting dose of 12.5 mg in patients where kidney status or hyperkalaemia warrant caution.

^gFinerenone has a different starting and target dose according to eGFR (10–20 mg, if eGFR ≤60 mL/min/1.73 m²; 20–40 mg, if eGFR >60 mL/min/1.73 m²).

^hDigoxin/digitoxin should be titrated according to plasma levels.

Table 7. ESC 2026 GL on HF. Recommendations for pharmacological management of chronic heart failure.

All patients with HF, independent of LVEF		
An SGLT2-I (dapagliflozin or empagliflozin) is recommended in patients with symptomatic HF independent of LVEF to reduce the risk of HFH or CV death. ^{241-245,326}	I	A
An MRA (sMRA for HFrEF and sMRA/nsMRA for HFpEF) is recommended in patients with symptomatic HF independent of LVEF to reduce the risk of HFH or CV death. ^{43,254-257}	I	A
Dynamic individualized dosing of loop diuretics according to volume status is recommended in patients with HF and signs and/or symptoms of congestion to alleviate HF symptoms, improve exercise capacity, and reduce the risk of HFH. ^{d 327-329}	I	A
Uptitration of FMT at least every 1-2 weeks in patients with HF, guided by symptoms, vital signs, and laboratory findings, to achieve optimal target doses shown to be efficacious in RCTs is recommended to reduce the risk of HFH or death. ^{274,311}	I	C
Continuation of FMT at the highest tolerated doses is recommended in all patients with HF, including those who become asymptomatic or with LVEF improvement, in order to reduce the risk of HFH and death. ³²¹	I	C
HFrEF		
A beta-blocker is recommended in stable patients with symptomatic HFrEF to reduce the risk of HFH and death. ^{e 36,287-293,330}	I	A
An ACE-I or ARNI is recommended in patients with symptomatic HFrEF to reduce the risk of HFH and death. ^{e 274-278}	I	A
Switching from an ACE-I or ARB to an ARNI is recommended in patients with symptomatic HFrEF to reduce the risk of HFH and death. ^{e 278}	I	B1
An ARB is recommended in patients with symptomatic HFrEF to reduce the risk of HFH and CV death if they are unable to tolerate an ACE-I or ARNI. ^{e 284-286,331}	I	A
A cardiac glycoside (digoxin or digitoxin) should be considered in patients with symptomatic HFrEF with LVEF ≤40%, despite optimal FMT, to reduce the risk of HFH. ^{303,304}	IIa	B1
Ivabradine should be considered for patients with symptomatic HFrEF, LVEF ≤35%, in sinus rhythm, resting heart rate >70 b.p.m., on the highest tolerated ACE-I/ARNI, MRA, SGLT2-I, and beta-blockers to reduce the risk of HFH or CV death. ²⁹⁴	IIa	B1
Ivabradine should be considered in patients with symptomatic HFrEF, LVEF ≤35%, in sinus rhythm, who are unable to tolerate a beta-blocker, on the highest tolerated ACE-I/ARNI and MRA to reduce the risk of HFH or CV death. ²⁹⁴	IIa	C
Hydralazine and isosorbide dinitrate should be considered in self-identified black patients with symptomatic HFrEF with LVEF ≤40% on top of optimal FMT to reduce the risk of HFH and death. ³⁰⁰	IIa	B2
Hydralazine and isosorbide dinitrate may be considered in patients with symptomatic HFrEF with LVEF ≤40% who cannot tolerate ARNI, ACE-I, or ARB to reduce the risk of HFH and death. ³⁰¹	IIb	C
Vericiguat may be considered in patients with symptomatic HFrEF and LVEF <45% despite treatment with optimal FMT to reduce the risk of HFH and CV death. ^{295,297,298}	IIb	B1
Gradual discontinuation of FMT under frequent clinical, laboratory, and imaging surveillance may be considered in highly selected patients who are asymptomatic with complete normalization of LV function and volume as well as natriuretic peptide levels after specific treatment of reversible causes of HF, in order to accommodate patient preference. ³²⁵	IIb	C
HFpEF		
ACE-I/ARB/ARNI may be considered in patients with symptomatic HFpEF to reduce the risk of HFH. ^{39,40,42,319,332-337}	IIb	C

ACE-I, angiotensin-converting enzyme inhibitor; ARB, angiotensin II receptor blocker; ARNI, angiotensin receptor-neprilysin inhibitor; CV, cardiovascular; FMT, foundational medical therapy; HF, heart failure; HFH, heart failure hospitalization; HFpEF, heart failure with preserved ejection fraction; HFrEF, heart failure with reduced ejection fraction; LV, left ventricular; LVEF, left ventricular ejection fraction; MRA, mineralocorticoid receptor antagonist; nsMRA, non-steroidal mineralocorticoid receptor antagonist; RCT, randomized clinical trial; SGLT2-I, sodium-glucose co-transporter 2 inhibitor; sMRA, steroidal mineralocorticoid receptor antagonist.

^aClass of recommendation.

^bLevel of evidence.

^cThe evidence for using MRAs in patients with HFrEF is based on RCTs conducted with sMRAs (spironolactone and eplerenone), whereas the evidence for patients with HFpEF originates from a meta-analysis of RCTs using both steroidal (spironolactone) and non-steroidal MRAs (finerenone).

^dThis recommendation is considered by the Task Force to have level of evidence A due to clear clinical effectiveness. Dynamic dosing of loop diuretics has been widely accepted as effective and therefore no adequately powered RCTs have ever been conducted or are likely to be conducted for ethical reasons.

^eNo large prospective RCT has been performed on the use of beta-blockers, ACE-I/ARNI/ARB exclusively in patients with LVEF 41%-49%.

Table 8. ESC 2023 GI on diabetes.

Recommendations for heart failure treatments in patients with heart failure with reduced ejection fraction and diabetes

Recommendations for the pharmacological treatment indicated in patients with HFrEF (NYHA class II–IV) and diabetes		
SGLT2 inhibitors (dapagliflozin, empagliflozin, or sotagliflozin ^c) are recommended in all patients with HFrEF and T2DM to reduce the risk of HF hospitalization and CV death. 189,491,494,497	I	A
Sacubitril/valsartan or an ACE-I is recommended in all patients with HFrEF and diabetes to reduce the risk of HF hospitalization and death. 471,501,502,527	I	A
Beta-blockers ^d are recommended in patients with HFrEF and diabetes to reduce the risk of HF hospitalization and death. 509–512,528	I	A

MRAs ^e are recommended in patients with HFrEF and diabetes to reduce the risk of HF hospitalization and death. ^{507,529}	I	A
An intensive strategy of early initiation of evidence-based treatment (SGLT2 inhibitors, ARNI/ACE-Is, beta-blockers, and MRAs), with rapid up-titration to trial-defined target doses starting before discharge and with frequent follow-up visits in the first 6 weeks following a HF hospitalization is recommended to reduce re-admissions or mortality. ⁴⁹⁰	I	B
Recommendations for other treatments indicated in selected patients with HFrEF (NYHA class II–IV) and diabetes		
Device therapy with an ICD, CRT-P, or CRT-D is recommended in patients with diabetes, as in the general population with HFrEF. ^{522–525}	I	A
ARBs are recommended in symptomatic patients with HFrEF and diabetes who do not tolerate sacubitril/valsartan or ACE-Is, to reduce the risk of HF hospitalization and CV death. ^{513–515}	I	A
Diuretics are recommended in patients with HFrEF and diabetes with signs and/or symptoms of fluid congestion to improve symptoms, exercise capacity, and HF hospitalization. ⁵²⁰	I	C
Ivabradine should be considered to reduce the risk of HF hospitalization and CV death in patients with HFrEF and diabetes in sinus rhythm, with a resting heart rate ≥ 70 b.p.m., who remain symptomatic despite treatment with beta-blockers (maximum tolerated dose), ACE-Is/ARBs, and MRAs. ⁵¹⁶	IIa	B
Hydralazine and isosorbide dinitrate should be considered in self-identified Black patients with diabetes and LVEF $\leq 35\%$ or with LVEF $< 45\%$ combined with a dilated left ventricle in NYHA class III–IV despite treatment with an ACE-I (or ARNI), a beta-blocker, and an MRA, to reduce the risk of HF hospitalization and death. ^{517,518}	IIa	B
Digoxin may be considered in patients with symptomatic HFrEF in sinus rhythm despite treatment with sacubitril/valsartan or an ACE-I, a beta-blocker, and an MRA, to reduce the risk of hospitalization. ⁵¹⁹	IIb	B

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ACE-I, angiotensin-converting enzyme inhibitor; ARB, angiotensin-II receptor blocker; ARNI, angiotensin receptor–neprilysin inhibitor; CRT-D, cardiac resynchronization therapy with defibrillator; CRT-P, cardiac resynchronization therapy-pacemaker; CV, cardiovascular; HF, heart failure; HFrEF, heart failure with reduced ejection fraction; ICD, implantable cardioverter defibrillator; LVEF, left ventricular ejection fraction; MRA, mineralocorticoid receptor antagonist; NYHA, New York Heart Association; SGLT2, sodium–glucose co-transporter-2; T2DM, type 2 diabetes mellitus.

^cSotagliflozin is a dual SGLT1/2 inhibitor.

^dSustained-released metoprolol succinate, carvedilol, bisoprolol, and nebivolol. ^eSpironolactone or eplerenone.

Recommendations for glucose-lowering medications in patients with type 2 diabetes with and without heart failure

Recommendations for glucose-lowering medications to reduce heart failure hospitalization in patients with type 2 diabetes with or without existing heart failure		
SGLT2 inhibitors (empagliflozin, canagliflozin, dapagliflozin, ertugliflozin, or sotagliflozin ^c) are recommended in patients with T2DM with multiple ASCVD risk factors or established ASCVD to reduce the risk of HF hospitalization. ^{71,150–153,541}	I	A
SGLT2 inhibitors (dapagliflozin, empagliflozin, or sotagliflozin ^c) are recommended in patients with T2DM and HFrEF to reduce the risk of HF hospitalization and CV death. ^{189,491,494,497}	I	A
Empagliflozin or dapagliflozin are recommended in patients with T2DM and LVEF >40% (HFmrEF and HFpEF) to reduce the risk of HF hospitalization or CV death. ^{530,532,533}	I	A
Recommendations for additional glucose-lowering agents with safety demonstrated for heart failure hospitalization in patients with type 2 diabetes if additional glucose control is needed		
GLP-1 RAs (lixisenatide, liraglutide, semaglutide, exenatide ER, dulaglutide, efpeglenatide) have a neutral effect on the risk of HF hospitalization, and should be considered for glucose-lowering treatment in patients with T2DM at risk of or with HF. ^{70,158–164,545}	IIa	A
DPP-4 inhibitors (sitagliptin and linagliptin) have a neutral effect on the risk of HF hospitalization, and should be considered for glucose-lowering treatment in patients with T2DM at risk of or with HF. ^{174,179,180}	IIa	A
Basal insulins (glargine and degludec) have a neutral effect on the risk of HF hospitalization and should be considered for glucose-lowering treatment in patients with T2DM at risk of or with HF. ^{553,554}	IIa	B
Metformin should be considered for glucose-lowering treatment in patients with T2DM and HF. ^{d,555,556,558}	IIa	B
Recommendations for glucose-lowering medications with an increased risk of heart failure hospitalization in patients with type 2 diabetes		
Pioglitazone is associated with an increased risk of incident HF in patients with diabetes and is not recommended for glucose-lowering treatment in patients at risk of HF (or with previous HF). ^{165,566}	III	A
The DPP-4 inhibitor saxagliptin is associated with an increased risk of HF hospitalization in patients with diabetes and is not recommended for glucose-lowering treatment in patients at risk of HF (or with previous HF). ¹⁷²	III	B
Recommendations for special consideration		
It is recommended to switch glucose-lowering treatment from agents without proven CV benefit or proven safety to agents with proven CV benefit. ^e	I	C

ASCVD, atherosclerotic cardiovascular disease; CV, cardiovascular; DPP-4, dipeptidyl peptidase-4; ER, extended release; GLP-1 RA, glucagon-like peptide-1 receptor agonist; HF, heart failure; HFmrEF, heart failure with mildly reduced ejection fraction; HFpEF, heart failure with preserved ejection fraction; HFrEF, heart failure with reduced ejection fraction; LVEF, left ventricular ejection fraction; MACE, major adverse cardiovascular events; s.c., subcutaneous; SGLT2, sodium–glucose co-transporter-2; T2DM, type 2 diabetes mellitus.

^cSotagliflozin is a dual SGLT1/2 inhibitor.

^dChronic and stable HF.

^eAgents with proven benefit: SGLT2 inhibitors: empagliflozin, canagliflozin, dapagliflozin, sotagliflozin^c; GLP-1 RAs: liraglutide, semaglutide s.c., dulaglutide, efpeglenatide. In the VERTIS CV trial, ertugliflozin did not reduce the primary endpoint (three-point MACE) nor the key secondary endpoint (CV death or HF hospitalization), but reduced HF hospitalization as a secondary exploratory endpoint.

Table 9. Pharmacological Treatment for HFrEF

ACC/AHA/HFSA 2022 GL on HF. STAGE C HF. Pharmacological Treatment for HFrEF (see Table 4 for diuretics)

Recommendations for Renin-Angiotensin System Inhibition With ACEi or ARB or ARNi

In patients with NYHA class II to III symptoms, the use of ARNi to reduce morbidity and mortality.	I A
In patients with previous or current symptoms of chronic HFrEF, use of ACEi to reduce morbidity and mortality when the use of ARNi is not feasible.	I A
In patients with previous or current symptoms of chronic HFrEF who are intolerant to ACEi because of cough or angioedema and when the use of ARNi is not feasible, use of ARB to reduce morbidity and mortality.	I A
In patients with previous or current symptoms of chronic HFrEF, in whom ARNi is not feasible, treatment with an ACEi or ARB provides high economic value.	Value Statement: High Value (A)
In patients with chronic symptomatic HFrEF NYHA class II or III who tolerate an ACEi or ARB, replacement by an ARNi to further reduce morbidity and mortality.	I B-R
In patients with chronic symptomatic HFrEF, treatment with an ARNi instead of an ACEi provides high economic value.	Value Statement: High Value (A)
ARNi should not be administered concomitantly with ACEi or within 36 hours of the last dose of an ACEi.	III B-R Harm
ARNi should not be administered to patients with any history of angioedema.	III C-LD Harm
ACEi should not be administered to patients with any history of angioedema	III C-LD Harm

Beta Blockers

In patients with HFrEF, with current or previous symptoms, use of 1 of the 3 beta blockers proven to reduce mortality (eg, bisoprolol, carvedilol, sustained-release metoprolol succinate) to reduce mortality and hospitalizations.	I A
In patients with HFrEF, with current or previous symptoms, beta-blocker therapy provides high economic value.	Value Statement: High Value (A)

Mineralocorticoid Receptor Antagonists (MRAs)

In patients with HFrEF and NYHA class II to IV symptoms, an MRA (spironolactone or eplerenone) to reduce morbidity and mortality, if eGFR is >30 mL/min/1.73 m² and serum potassium is <5.0 mEq/L. Careful monitoring of potassium, renal function, and diuretic dosing should be performed at initiation and closely monitored thereafter to minimize risk of hyperkalemia and renal insufficiency.

I A

In patients with HFrEF and NYHA class II to IV symptoms, MRA therapy provides high economic value.

Value Statement:
High Value (A)

In patients taking MRA whose serum potassium cannot be maintained at <5.5 mEq/L, MRA should be discontinued to avoid lifethreatening hyperkalemia

III B-NR
Harm

Sodium-Glucose Cotransporter 2 Inhibitors

In patients with symptomatic chronic HFrEF, SGLT2i to reduce hospitalization for HF and cardiovascular mortality, irrespective of the presence of type 2 diabetes.

I A

In patients with symptomatic chronic HFrEF, SGLT2i therapy provides intermediate economic value.

Value Statement:
Intermediate Value (A)

Hydralazine and Isosorbide Dinitrate

For patients self-identified as African American with NYHA class III-IV HFrEF who are receiving optimal medical therapy, the combination of hydralazine and isosorbide dinitrate to improve symptoms and reduce morbidity and mortality.

I A

For patients self-identified as African American with NYHA class III to IV HFrEF who are receiving optimal medical therapy with ACEi or ARB, beta blockers, and MRA, the combination of hydralazine and isosorbide dinitrate provides high economic value.

Value Statement:
High Value (B-NR)

In patients with current or previous symptomatic HFrEF who cannot be given first-line agents, such as ARNi, ACEi, or ARB, because of drug intolerance or renal insufficiency, a combination of hydralazine and isosorbide dinitrate to reduce morbidity and mortality.

IIb C-LD

Other Drug Treatment

In patients with HF class II to IV symptoms, omega-3 polyunsaturated fatty acid (PUFA) supplementation to use as adjunctive therapy to reduce mortality and cardiovascular hospitalizations.

IIb B-R

In patients with HF who experience hyperkalemia (serum potassium level ≥ 5.5 mEq/L) while taking a renin-angiotensin-aldosterone System inhibitor (RAASi), the effectiveness of potassium binders (patiomer, sodium zirconium cyclosilicate) to improve outcomes by facilitating continuation of RAASi therapy is uncertain.

IIb B-R

In patients with chronic HFrEF without a specific indication (eg, venous thromboembolism [VTE], AF, a previous thromboembolic event,

II B-NR
No benefit

or a cardioembolic source), anticoagulation is not recommended.

GDMT Dosing: Sequencing and Uptitration

In patients with HFrEF, titration of guideline-directed medication dosing to achieve target doses showed to be efficacious in RCTs, to reduce cardiovascular mortality and HF hospitalizations, unless not well tolerated. I A

In patients with HFrEF, titration and optimization of guideline-directed medications as frequently as every 1 to 2 weeks depending on the patient's symptoms, vital signs, and laboratory findings to optimize management. IIa C-EO

Additional Medical Therapies

Ivabradine

For patients with symptomatic (NYHA class II to III) stable chronic HFrEF (LVEF $\leq 35\%$) Who are receiving GDMT, including a beta blocker at maximum tolerated dose, and who are in sinus rhythm with a heart rate of ≥ 70 bpm at rest, ivabradine to reduce HF hospitalizations and cardiovascular death. IIa B-R

Digoxin

In patients with symptomatic HFrEF despite GDMT (or who are unable to tolerate GDMT), digoxin to decrease hospitalizations for HF. IIb B-R

Soluble Guanylyl Cyclase Stimulators

In selected high-risk patients with HFrEF and recent worsening of HF already on GDMT, an oral soluble guanylate cyclase stimulator (vericiguat) to reduce HF hospitalization and cardiovascular death. IIb B-R

Drugs Commonly Used for HFrEF (Stage C HF)

Drug	Initial Daily Dose(s)	Target Doses(s)	Mean Doses Achieved in Clinical Trials	References
ACEi				
Captopril	6.25 mg 3 times daily	50 mg 3 times daily	122.7 mg total daily	19
Enalapril	2.5 mg twice daily	10–20 mg twice daily	16.6 mg total daily	3
Fosinopril	5–10 mg once daily	40 mg once daily	NA	...
Lisinopril	2.5–5 mg once daily	20–40 mg once daily	32.5–35.0 mg total daily	17
Perindopril	2 mg once daily	8–16 mg once daily	NA	...
Quinapril	5 mg twice daily	20 mg twice daily	NA	...
Ramipril	1.25–2.5 mg once daily	10 mg once daily	NA	...
Trandolapril	1 mg once daily	4 mg once daily	NA	...
ARB				
Candesartan	4–8 mg once daily	32 mg once daily	24 mg total daily	20
Losartan	25–50 mg once daily	50–150 mg once daily	129 mg total daily	18
Valsartan	20–40 mg once daily	160 mg twice daily	254 mg total daily	21
ARNi				
Sacubitril-valsartan	49 mg sacubitril and 51 mg valsartan twice daily (therapy may be initiated at 24 mg sacubitril and 26 mg valsartan twice daily)	97 mg sacubitril and 103 mg valsartan twice daily	182 mg sacubitril and 193 mg valsartan total daily	22
Beta blockers				
Bisoprolol	1.25 mg once daily	10 mg once daily	8.6 mg total daily	1
Carvedilol	3.125 mg twice daily	25–50 mg twice daily	37 mg total daily	23
Carvedilol CR	10 mg once daily	80 mg once daily	NA	...
Metoprolol succinate extended release (metoprolol CR/XL)	12.5–25 mg once daily	200 mg once daily	159 mg total daily	11
Mineralocorticoid receptor antagonists				
Spironolactone	12.5–25 mg once daily	25–50 mg once daily	26 mg total daily	6
Eplerenone	25 mg once daily	50 mg once daily	42.6 mg total daily	13
SGLT2i				
Dapagliflozin	10 mg once daily	10 mg once daily	9.8 mg total daily	8
Empagliflozin	10 mg once daily	10 mg once daily	NR	9
Isosorbide dinitrate and hydralazine				
Fixed dose combination	20 mg isosorbide dinitrate and 37.5 mg hydralazine 3 times daily	40 mg isosorbide dinitrate and 75 mg hydralazine 3 times daily	90 mg isosorbide dinitrate and ~175 mg hydralazine total daily	10
Isosorbide dinitrate and hydralazine	20–30 mg isosorbide dinitrate and 25–50 mg hydralazine 3–4 times daily	120 mg isosorbide dinitrate total daily in divided doses and 300 mg hydralazine total daily in divided doses	NA	24
I₁ Channel inhibitor				
Ivabradine	5 mg twice daily	7.5 mg twice daily	12.8 total daily	25–27
Soluble guanylate cyclase stimulator				
Vericiguat	2.5 mg once daily	10 mg once daily	9.2 mg total daily	28
Digoxin	0.125–0.25 mg daily (modified according to monogram)	Individualized variable dose to achieve serum digoxin concentration 0.5–<0.9 ng/mL	NA	29,30

ACE indicates angiotensin-converting enzyme; ARB, angiotensin receptor blocker; CR, controlled release; CR/XL, controlled release/extended release; HF, heart failure; HFrEF, heart failure with reduced ejection fraction; NA, not applicable; NR, not reported; and SGLT2i, sodium glucose cotransporter 2 inhibitor.

Benefits of Evidence-Based Therapies for Patients With HFrEF

Evidence-Based Therapy	Relative Risk Reduction in All-Cause Mortality in Pivotal RCTs, %	NNT to Prevent All-Cause Mortality Over Time*	NNT for All-Cause Mortality (Standardized to 12 mo)	NNT for All-Cause Mortality (Standardized to 36 mo)
ACEi or ARB	17	22 over 42 mo	77	26
ARNi†	16	36 over 27 mo	80	27
Beta blocker	34	28 over 12 mo	28	9
Mineralocorticoid receptor antagonist	30	9 over 24 mo	18	6
SGLT2i	17	43 over 18 mo	63	22
Hydralazine or nitrate‡	43	25 over 10 mo	21	7
CRT	36	12 over 24 mo	24	8
ICD	23	14 over 60 mo	70	23

ACEi indicates angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blocker; ARNi, angiotensin receptor neprilysin inhibitor; CRT, cardiac resynchronization therapy; HFrEF, heart failure with reduced ejection fraction; ICD, implantable cardioverter-defibrillator; NNT, number needed to treat; RCT, randomized controlled trial; and SGLT2i, sodium-glucose cotransporter-2 inhibitor.

*Median duration follow-up in the respective clinical trial.

†Benefit of ARNi therapy incremental to that achieved with ACEi therapy. For the other medications shown, the benefits are based on comparisons to placebo control.

‡Benefit of hydralazine-nitrate therapy was limited to African American patients in this trial.

AHA/ACC 2025 GL on hypertension. GDMT for Patients With Hypertension and HFrEF

Drug Class	Notes on Use
BB	In patients with HFrEF, even if asymptomatic, use 1 of the 3 BBs proven to reduce mortality and hospitalizations (bisoprolol, carvedilol, metoprolol succinate).
MRA	In patients with symptomatic HFrEF, spironolactone or eplerenone is recommended to reduce morbidity and mortality if eGFR is >30 mL/min/1.73 m ² and potassium is <5.0 mEq/L.
RAASi with ACEi or ARB or ARNi	In patients with HFrEF and NYHA functional class II to III symptoms, ARNi is recommended to reduce morbidity and mortality. When the use of ARNi is not feasible, ACEi or ARB is recommended to reduce morbidity and mortality.
SGLT2i	SGLT2i are recommended in patients with symptomatic HFrEF to reduce hospitalization and cardiovascular mortality irrespective of the presence of type 2 diabetes.
Additional GDMT to be added as indicated	
Hydralazine and isosorbide dinitrate	For patients self-identified as Black with NYHA functional class III to IV HFrEF who are receiving optimal medical therapy, the combination of hydralazine and isosorbide dinitrate is recommended to improve symptoms and reduce morbidity and mortality. In patients with current or previous symptomatic HFrEF who cannot be given first-line agents, such as ARNi, ACEi, or ARB, because of drug intolerance or renal insufficiency, a combination of hydralazine and isosorbide dinitrate might be considered to reduce morbidity and mortality.

ACEi indicates angiotensin-converting enzyme inhibitors; ARB, angiotensin receptor blockers; ARNi, angiotensin receptor-neprilysin inhibitors; BB, beta blocker; eGFR, estimated glomerular filtration rate; GDMT, guideline-directed medical therapy; HFrEF, heart failure with reduced ejection fraction; MRA, mineralocorticoid receptor antagonist; NYHA, New York Heart Association; RAASi, renin-angiotensin-aldosterone system inhibitors; and SGLT2i, sodium-glucose cotransporter inhibitors.

Table 10. ACC/AHA/HFSA 2022 GL on HF. STAGE C HF. Heart Failure With Mildly Reduced EF (HFmrEF) and Improved EF (HFimpHF)

HF With Mildly Reduced Ejection Fraction

In patients with HFmrEF, SGLT2i for decreasing HF hospitalizations and cardiovascular mortality.¹ IIa B-R

In patients with current or previous symptomatic HFmrEF (LVEF, 41%–49%), use of evidence-based beta blockers for HFrEF, ARNi, ACEi, or ARB, and MRAs to reduce the risk of HF hospitalization and cardiovascular mortality, particularly among patients with LVEF on the lower end of this spectrum. IIa B-NR

HF With Improved Ejection Fraction

In patients with HFimpEF after treatment, continue GDMT continued to prevent relapse of HF and LV dysfunction, even in patients who may become asymptomatic. I B-R

Table 10. ACC/AHA/HFSA 2022 GL on HF. STAGE C HF. Drugs of Unproven Value or That May Worsen HF

In patients with HFrEF, dihydropyridine calcium channel-blocking drugs are not recommended treatment for HF.	III A No benefit
In patients with HFrEF, vitamins, nutritional supplements, and hormonal therapy are not recommended other than to correct specific deficiencies.	III B-R No benefit
In patients with HFrEF, nondihydropyridine calcium channel-blocking drugs are not recommended.	III A Harm
In patients with HFrEF, class IC antiarrhythmic medications and dronedarone may increase the risk of mortality.	III A Harm
In patients with HFrEF, thiazolidinediones increase the risk of worsening HF symptoms and hospitalizations.	III A Harm
In patients with type 2 diabetes and high cardiovascular risk, the dipeptidyl peptidase-4 (DPP-4) inhibitors saxagliptin and alogliptin increase the risk of HF hospitalization and should be avoided in patients with HF.	III B-R Harm
In patients with HFrEF, NSAIDs worsen HF symptoms and should be avoided or withdrawn whenever possible.	III B-NR Harm

Selected Prescription Medications That May Cause or Exacerbate HF

Drug or Therapeutic Class	Associated With HF		Magnitude of HF Induction or Precipitation	LOE for HF Induction or Precipitation	Possible Mechanism(s)	Onset
	Causes Direct Myocardial Toxicity	Exacerbates Underlying Myocardial Dysfunction				
COX, nonselective inhibitors (NSAIDs)		X	Major	B	Prostaglandin inhibition leading to sodium and water retention, increased systemic vascular resistance, and blunted response to diuretics	Immediate
COX, selective inhibitors (COX-2 inhibitors)		X	Major	B		
Thiazolidinediones		X	Major	A	Possible calcium channel blockade	Intermediate
Saxagliptin		X	Major	A	Unknown	Intermediate to delayed
Alogliptin		X	Major	A		
Flecainide		X	Major	A	Negative inotrope, proarrhythmic effects	Immediate to intermediate
Disopyramide		X	Major	B		
Sotalol		X	Major	A	Proarrhythmic properties, beta blockade	Immediate to intermediate
Dronedrone		X	Major	A	Negative inotrope	
Alpha-1 blockers						
Doxazosin		X	Moderate	B	Beta-1-receptor stimulation with increases in renin and aldosterone	Intermediate to delayed
Diltiazem		X	Major	B	Negative inotrope	Immediate to intermediate
Verapamil		X	Major	B		
Nifedipine		X	Moderate	C		

COX indicates cyclo-oxygenase; HF, heart failure; LOE, Level of Evidence; and NSAID, nonsteroidal anti-inflammatory drug.

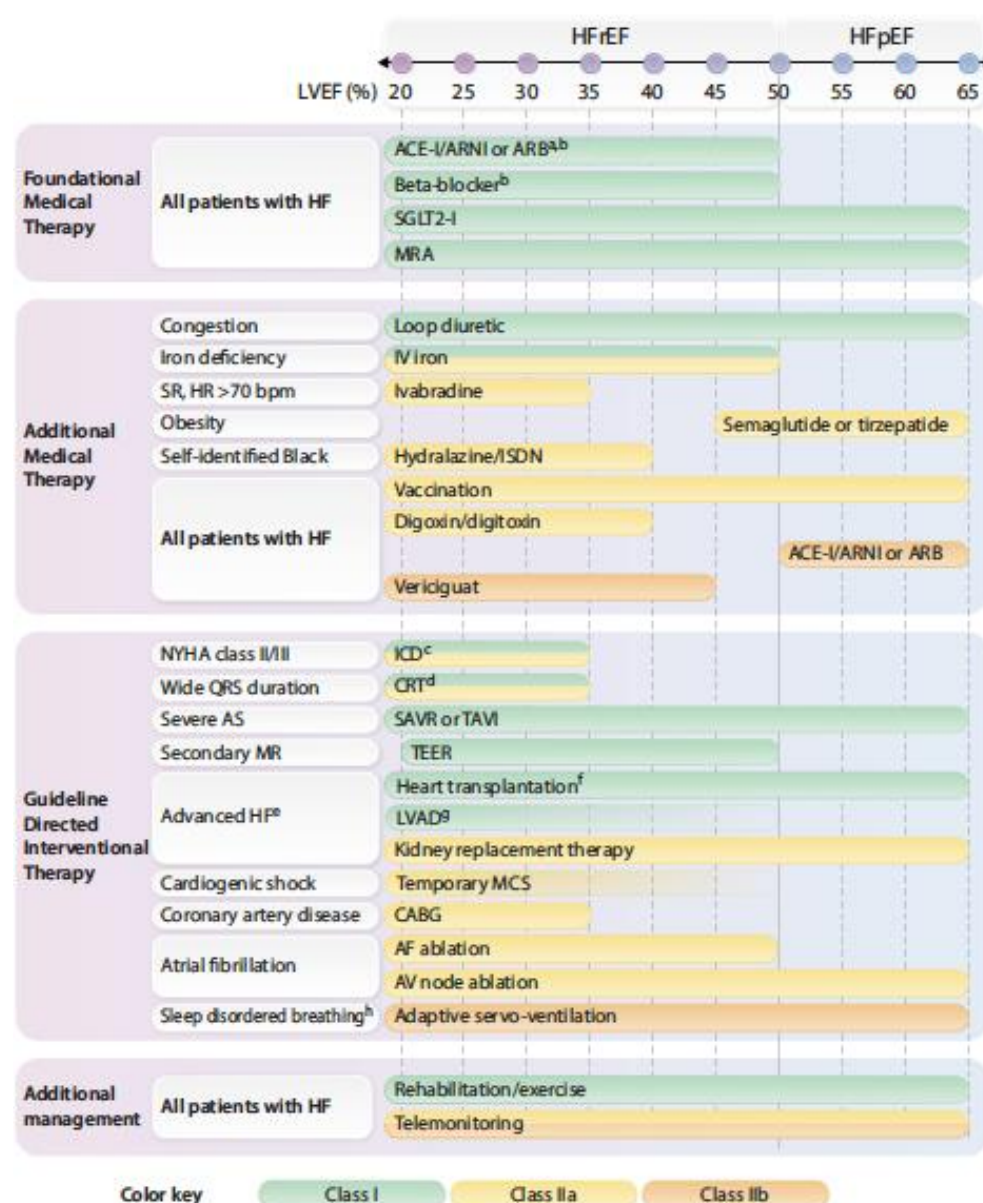


Figure 1. ESC 2026 GL on HF. Management of heart failure.

ACE-I, angiotensin-converting enzyme inhibitor; AF, atrial fibrillation; ARB, angiotensin II receptor blocker; ARNI, angiotensin receptor–neprilysin inhibitor; AS, aortic stenosis; AV, atrioventricular; CABG, coronary artery bypass grafting; CRT, cardiac resynchronization therapy; HF, heart failure; HFpEF, heart failure with preserved ejection fraction; HFrEF, heart failure with reduced ejection fraction; HR, heart rate; ICD, implantable cardioverter-defibrillator; ISDN, isosorbide dinitrate; IV, intravenous; LVAD, left ventricular assist device; LVEF, left ventricular ejection fraction; MCS, mechanical circulatory support; MR, mitral regurgitation; MRA, mineralocorticoid receptor antagonist; TEER, transcatheter edge-to-edge repair; NYHA, New York Heart Association; SAVR, surgical aortic valve replacement; SGLT2-I, sodium–glucose co-transporter 2 inhibitor; SR, sinus rhythm; TAVI, transcatheter aortic valve implantation.

Green colour refers to Class I recommendation. Yellow colour refers to Class IIa recommendation. Orange colour refers to Class IIb recommendation.

^aAn ARB is recommended in patients with symptomatic HFrEF if they are unable to tolerate an ACE-I or ARNI.

- bNo large prospective randomized controlled trial has been performed on the use of beta-blockers, ACE-I/ARNI/ARB exclusively in patients with LVEF 41%–49%.
- cClass of recommendation for ICD differs according to ischaemic vs nonischaemic aetiology.
- dClass of recommendation for CRT differs according to QRS duration and morphology (see [Figure 10](#) and [Recommendation Table 7](#)).
- eCriteria for advanced HF are listed in [Table 14](#).
- fIndications and contraindications for heart transplantation are listed in [Table 17](#).
- gIndications and contraindications for LVAD implantation are listed in [Table 16](#).
- hPredominantly obstructive sleep apnoea.

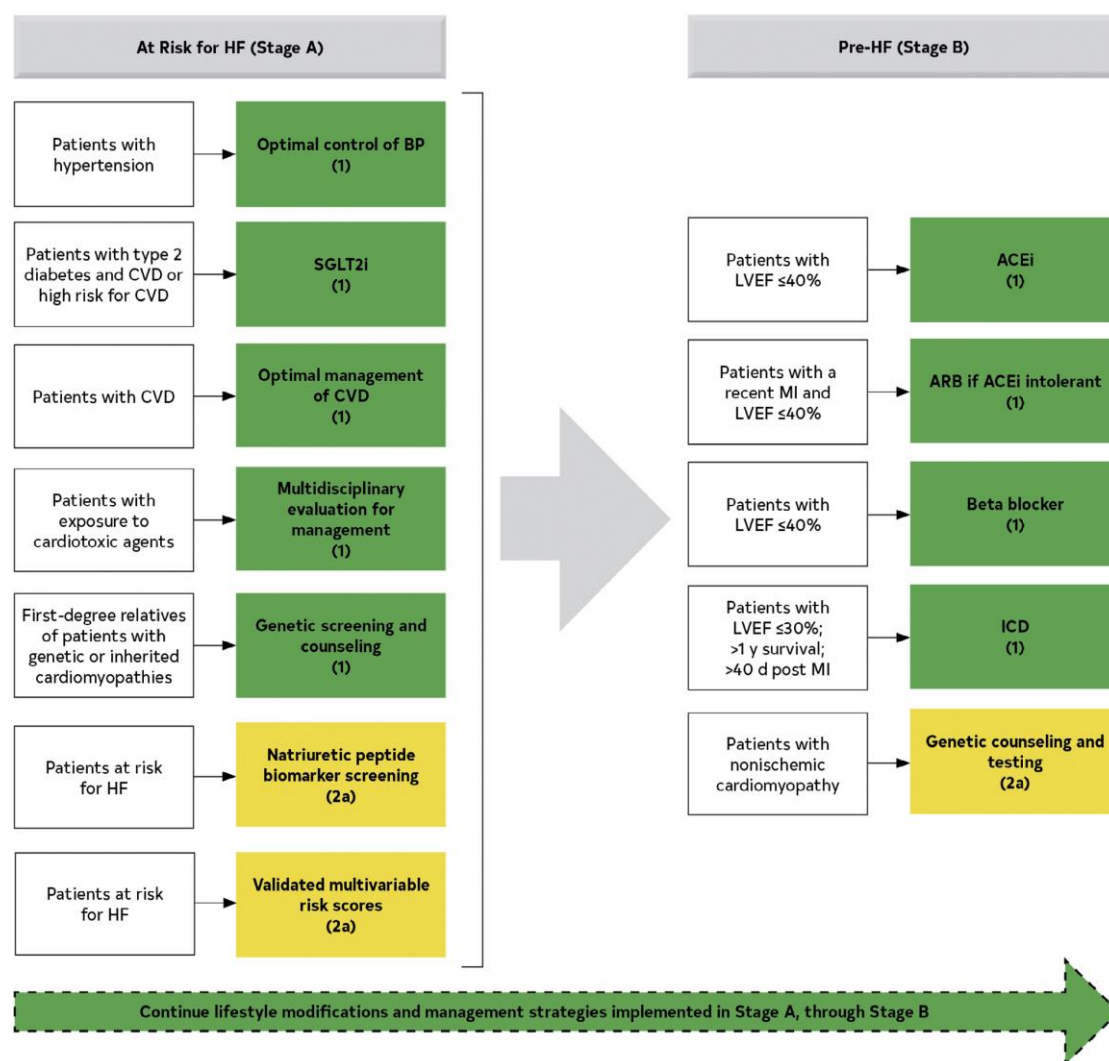


Figure 3. ACC/AHA/HFSA 2022 GI on HF. Recommendations (Class 1 and 2a) for Patients at Risk of HF (Stage A) and Those With Pre-HF (Stage B).

COR 1 and COR 2a for patients at risk for HF (stage A) and those with pre-HF (stage B) are shown. Management strategies implemented in patients at risk for HF (stage A) should be continued though stage B.

ACEi indicates angiotensin converting enzyme inhibitor; ARB, angiotensin receptor blocker; BP, blood pressure; COR, Class of Recommendation; CVD, cardiovascular disease; HF, heart failure; ICD, implantable cardioverter-defibrillator; LVEF, left ventricular ejection fraction; MI, myocardial infarction; and SGLT2i, sodium glucose cotransporter 2 inhibitor.

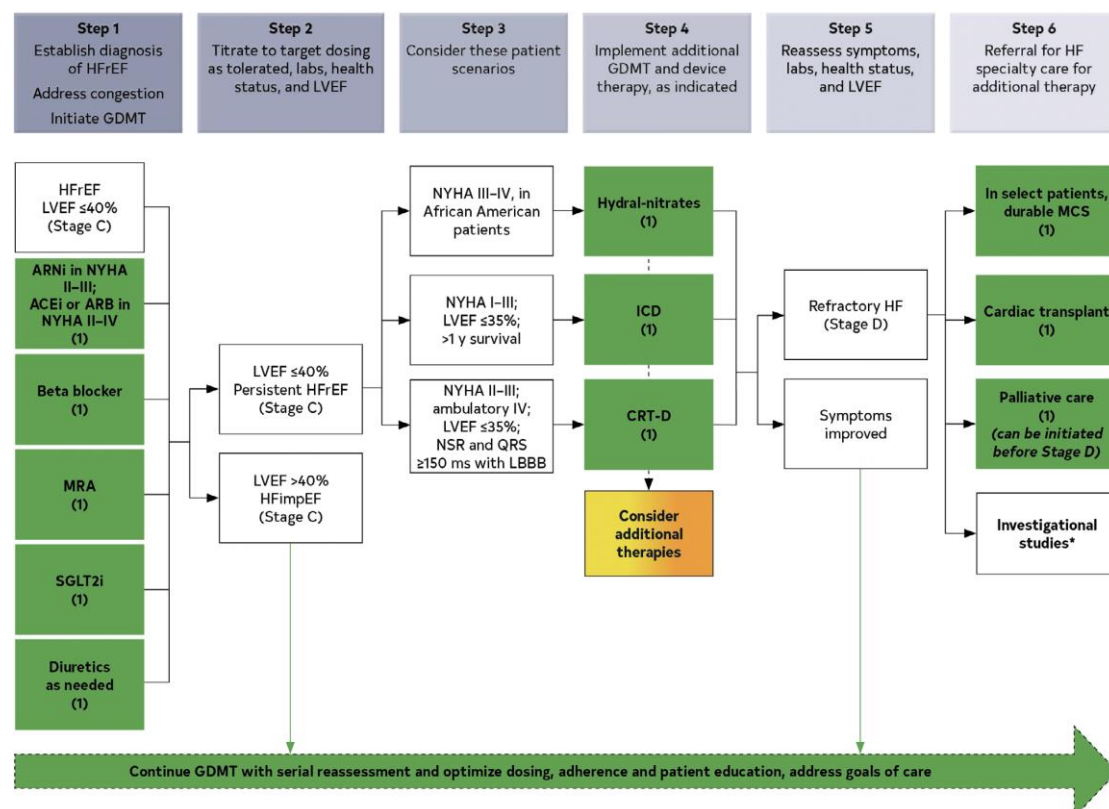


Figure 4. ACC/AHA/HFSA 2022 GI on HF. Treatment of HFrEF Stages C and D.

Treatment recommendations for patients with HFrEF are displayed. Step 1 medications may be started simultaneously at initial (low) doses recommended for HFrEF. Alternatively, these medications may be started sequentially, with sequence guided by clinical or other factors, without need to achieve target dosing before initiating next medication. Medication doses should be increased to target as tolerated.

ACEi indicates angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blocker; ARNi, angiotensin receptor-neprilysin inhibitor; COR, Class of Recommendation; CRT, cardiac resynchronization therapy; GDMT, guideline-directed medical therapy; ICD, implantable cardioverter-defibrillator; hydral-nitrates, hydralazine and isosorbide dinitrate; HFrEF, heart failure with reduced ejection fraction; LBBB, left bundle branch block; MCS, mechanical circulatory support; LVEF, left ventricular ejection fraction; MRA, mineralocorticoid receptor antagonist; NSR, normal sinus rhythm; NYHA, New York Heart Association; and SGLT2i, sodium-glucose cotransporter 2 inhibitor.

*Participation in investigational studies is appropriate for stage C, NYHA class II and III HF.

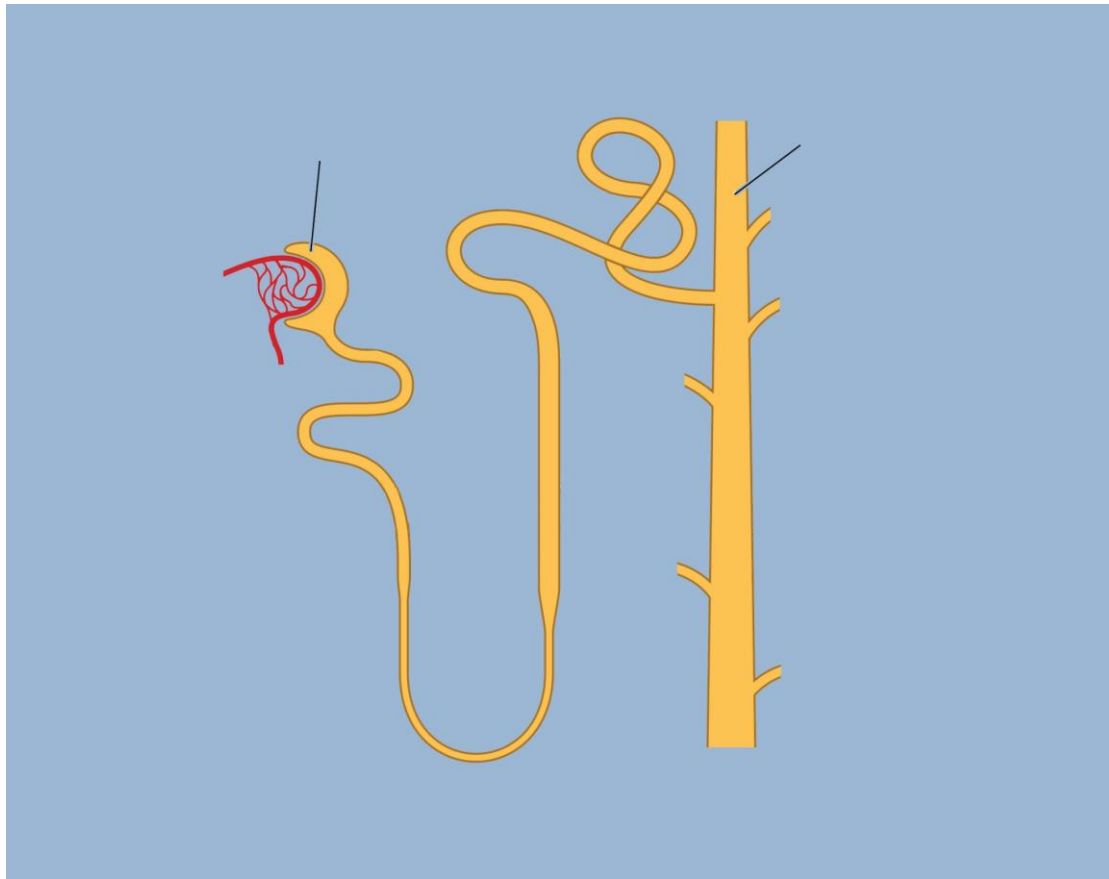


Figure 5. Sites of diuretic action in the nephron.

K⁺-sparing diuretics refers to the epithelial sodium-channel inhibitors (e.g., amiloride and triamterene) and mineralocorticoid-receptor antagonists (e.g., spironolactone and eplerenone). Sodium is reabsorbed in the distal tubule and collecting ducts through an aldosterone-sensitive sodium channel and by activation of an ATP-dependent sodium–potassium pump. Through both mechanisms, potassium is secreted into the lumen to preserve electroneutrality. Sodium-channel inhibitors preserve potassium by interfering with the sodium–potassium pump, whereas mineralocorticoid-receptor antagonists spare potassium through their inhibitory effect on aldosterone.

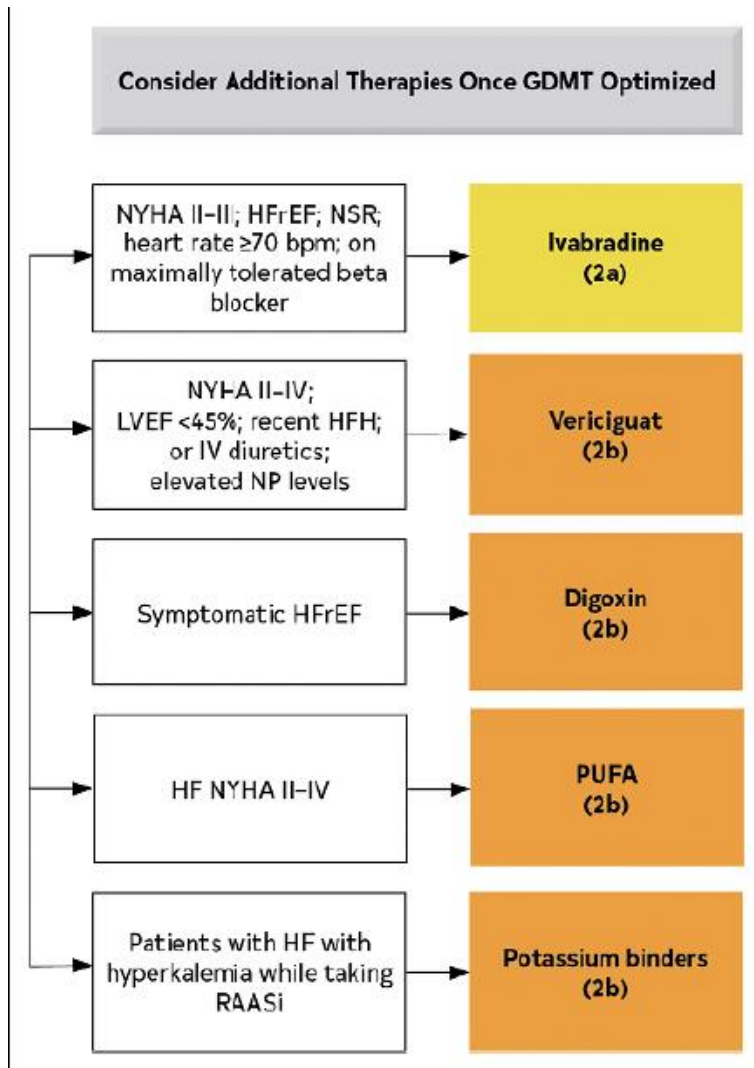


Figure 6. ACC/AHA/HFSA 2021 GI on HF. Additional Medical Therapies for Patients With HFrEF.

Recommendations for additional medical therapies that may be considered for patients with HF are shown.

GDMT indicates guideline-directed medical therapy; HF, heart failure; HFH, heart failure hospitalization; HFrEF, heart failure with reduced ejection fraction; IV, intravenous; LVEF, left ventricular ejection fraction; LVESD, left ventricular end systolic dimension; MV, mitral valve; MR, mitral regurgitation; NP, natriuretic peptide; NSR, normal sinus rhythm; NYHA, New York Heart Association; and RAASi, renin-angiotensin-aldosterone system inhibitors.

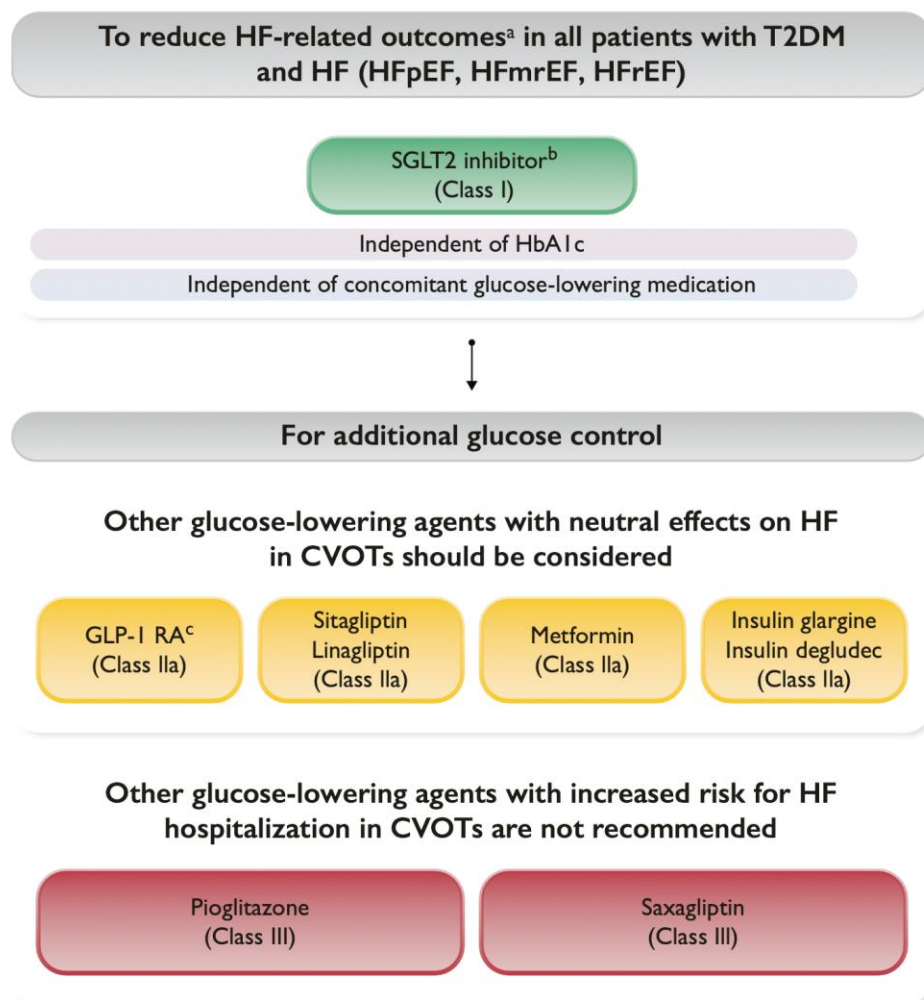


Figure 7. ESC 2023 GL on diabetes. Glucose-lowering treatment of patients with heart failure and type 2 diabetes.

CVOT, cardiovascular outcomes trial; DPP-4, dipeptidyl peptidase-4; GLP-1 RA, glucagon-like peptide-1 receptor agonist; Hb1Ac, glycated haemoglobin; HF, heart failure; HFmrEF, heart failure with mildly reduced ejection fraction; HFpEF, heart failure with preserved ejection fraction; HFrEF, heart failure with reduced ejection fraction; SGLT2, sodium–glucose co-transporter-2; T2DM, type 2 diabetes mellitus.

^aThis includes HF hospitalization or CV death. ^bEmpagliflozin, dapagliflozin, or sotagliflozin in patients with HFrEF, empagliflozin or dapagliflozin in patients with HFpEF and HFmrEF. ^cPreferred in patients with atherosclerotic cardiovascular disease and if weight reduction is needed; do not combine with DPP-4 inhibitors.

Table 11. Device therapy in HF patients receiving optimal, guideline-directed medical therapy

ACC/AHA/HFSA 2022 GL on HF. STAGE C HF. Device and Interventional Therapies for HFrEF

ICDs and CRTs

In patients with nonischemic DCM or ischemic heart disease at least 40 days post-MI with LVEF $\leq 35\%$ and NYHA class II or III symptoms on chronic GDMT, who have reasonable expectation of meaningful survival for >1 year, ICD therapy for primary prevention of SCD to reduce total mortality. I A

A transvenous ICD provides high economic value in the primary prevention of SCD particularly when the patient's risk of death caused by ventricular arrhythmia is deemed high and the risk of nonarrhythmic death (either cardiac or noncardiac) is deemed low based on the patient's burden of comorbidities and functional status. Value Statement:
High Value (A)

In patients at least 40 days post-MI with LVEF $\leq 30\%$ and NYHA class I symptoms while receiving GDMT, who have reasonable expectation of meaningful survival for >1 year, ICD therapy for primary prevention of SCD to reduce total mortality. I B-R

For patients who have LVEF $\leq 35\%$, sinus rhythm, left bundle branch block (LBBB) with a QRS duration ≥ 150 ms, and NYHA class II, III, or ambulatory IV symptoms on GDMT, CRT is indicated to reduce total mortality, reduce hospitalizations, and improve symptoms and QOL. I B-R

For patients who have LVEF $\leq 35\%$, sinus rhythm, LBBB with a QRS duration of ≥ 150 ms, and NYHA class II, III, or ambulatory IV symptoms on GDMT, CRT implantation provides high economic value. Value Statement:
High Value (B-NR)

For patients who have LVEF $\leq 35\%$, sinus rhythm, a non-LBBB pattern with a QRS duration ≥ 150 ms, and NYHA class II, III, or ambulatory class IV symptoms on GDMT, CRT can be useful to reduce total mortality, reduce hospitalizations, and improve symptoms and QOL. IIa B-R

In patients with high-degree or complete heart block and LVEF of 36% to 50%, CRT to reduce total mortality, reduce hospitalizations, and improve symptoms and QOL. IIa B-R

For patients who have LVEF $\leq 35\%$, sinus rhythm, LBBB with a QRS duration of 120 to 149 ms, and NYHA class II, III, or ambulatory IV symptoms on GDMT, CRT to reduce total mortality, reduce hospitalizations, and improve symptoms and QOL. IIa B-NR

In patients with AF and LVEF $\leq 35\%$ on GDMT, CRT to reduce total mortality, improve symptoms and QOL, and increase LVEF, if:
a) the patient requires ventricular pacing or otherwise meets CRT criteria and
b) atrioventricular nodal ablation or pharmacological rate control will allow near 100% ventricular pacing with CRT. IIa B-NR

For patients on GDMT who have LVEF $\leq 35\%$ and are undergoing placement of a new or replacement device implantation with anticipated requirement for significant ($>40\%$) ventricular pacing, CRT to reduce total mortality, reduce hospitalizations, and improve symptoms and QOL.	IIa B-NR
In patients with genetic arrhythmogenic cardiomyopathy with high-risk features of sudden death, with EF $\leq 45\%$, implantation of ICD is to decrease sudden death.	IIa B-NR
For patients who have LVEF $\leq 35\%$, sinus rhythm, a non-LBBB pattern with QRS duration of 120 to 149 ms, and NYHA class III or ambulatory class IV on GDMT, CRT to reduce total mortality, reduce hospitalizations, and improve symptoms and QOL.	IIb B-NR
For patients who have LVEF $\leq 30\%$, ischemic cause of HF, sinus rhythm, LBBB with a QRS duration ≥ 150 ms, and NYHA class I symptoms on GDMT, CRT to reduce hospitalizations and improve symptoms and QOL.	IIb B-NR
In patients with QRS duration <120 ms, CRT is not recommended.	III B-R No Benefit
For patients with NYHA class I or II symptoms and non-LBBB pattern with QRS duration <150 ms, CRT is not recommended.	III B-NR No benefit
For patients whose comorbidities or frailty limit survival with good functional capacity to <1 year, ICD and cardiac resynchronization therapy with defibrillation (CRT-D) are not indicated.	III C-LD No benefit

Recommendations for implantable cardioverter-defibrillator implantation

An ICD is recommended in patients who have recovered from a ventricular arrhythmia causing haemodynamic instability (secondary prevention), and who are expected to survive for >1 year with good functional status, in the absence of reversible causes, or unless the ventricular arrhythmia has occurred <48 h after an MI, to reduce the risk of sudden death and all-cause death. ⁵⁴⁶	I	A
An ICD is recommended in patients with symptomatic HFrEF (NYHA class II/III) of an ischaemic aetiology (unless they have had an MI in the prior 40 days), and an LVEF ≤35% despite ≥3 months of optimal FMT, provided they are expected to survive longer than 1 year with good functional status, to reduce the risk of sudden death and all-cause death. ^{540,542,573,574}	I	B1
An ICD should be considered in patients with symptomatic HFrEF (NYHA class II/III) of a non-ischaemic aetiology, and an LVEF ≤35% despite ≥3 months of optimal FMT, provided they are expected to survive longer than 1 year with good functional status, to reduce the risk of sudden death and all-cause death. ^{540,543,544,575}	IIa	B1
Prior to generator replacement for CIEDs, a shared decision-making process between the patient and a cardiologist experienced in CIEDs and HF should be considered to ensure that the balance between risks and benefits still favour a CIED. ^{576–580}	IIa	C
A wearable cardioverter-defibrillator may be considered in patients with HF who are at risk of sudden cardiac death for a limited period in order to increase survival as a bridge to decision for permanent ICD implantation or while listed for heart transplantation. ^{581–584}	IIb	C
ICD implantation for primary prevention is not recommended within 40 days of an MI as implantation during this period does not improve prognosis. ^{558,559}	III	B1
ICD implantation is not recommended in patients in NYHA class IV with severe symptoms refractory to pharmacological therapy unless they are candidates for CRT, a ventricular assist device, or heart transplantation. ^{574,585–587}	III	C

CIED, cardiac implantable electronic device; CRT, cardiac resynchronization therapy; FMT, foundational medical therapy; HF, heart failure; HFrEF, heart failure with reduced ejection fraction; ICD, implantable cardioverter-defibrillator; LVEF, left ventricular ejection fraction; MI, myocardial infarction; NYHA, New York Heart Association.

Recommendations for cardiac resynchronization therapy implantation

CRT is recommended in patients with symptomatic HFrEF, LVEF $\leq 35\%$, despite optimal FMT, in SR with LBBB and QRS duration ≥ 150 ms in order to improve symptoms and reduce the risk of hospitalizations and death. ³⁸⁸⁻³⁹⁸	I	A
An upgrade to CRT should be considered in patients with an LVEF $\leq 35\%$ who have received a conventional pacemaker or an ICD and subsequently develop worsening HF despite optimal FMT and who have a significant proportion of RV pacing in order to reduce the risk of HFH or death. ⁴¹²	IIa	B1
CRT, rather than RV pacing, should be considered in patients with HFrEF regardless of NYHA class or QRS width who have an indication for ventricular pacing for high-degree AV block in order to reduce the risk of HFH and death. ⁴⁰⁹	IIa	B1
CRT should be considered in patients with symptomatic HFrEF, LVEF $\leq 35\%$, despite optimal FMT, who are in SR with non-LBBB QRS morphology and QRS duration ≥ 150 ms in order to improve symptoms and reduce morbidity and death. ³⁸⁸⁻³⁹⁸	IIa	C
CRT should be considered in patients with symptomatic HFrEF, LVEF $\leq 35\%$, despite optimal FMT, who are in SR with LBBB QRS morphology and QRS duration of 130–149 ms in order to improve symptoms and reduce morbidity and death. ^{390,417}	IIa	C
CRT may be considered in patients with symptomatic HFrEF, LVEF $\leq 35\%$, despite optimal FMT, who are in SR with non-LBBB QRS morphology and QRS duration of 130–149 ms in order to improve symptoms and reduce morbidity and death. ^{391,397}	IIb	C
Initiation of FMT and planning for CRT implantation may be considered simultaneously in patients with symptomatic HFrEF, an LBBB with QRS ≥ 150 ms, and LVEF $\leq 35\%$, to improve symptoms and reduce morbidity and death, although reassessment of LVEF should be conducted prior to CRT implantation. ⁴¹⁸⁻⁴²³	IIb	C
CRT is not recommended in patients with a QRS duration < 130 ms who do not have an indication for pacing due to high-degree AV block. ^{410,424,425}	III	A

AV, atrioventricular; CRT, cardiac resynchronization therapy; FMT, foundational medical therapy; HF, heart failure; HFH, heart failure hospitalization; HFrEF, heart failure with reduced ejection fraction; ICD, implantable cardioverter-defibrillator; LBBB, left bundle branch block; LVEF, left ventricular ejection fraction; NYHA, New York Heart Association; RV, right ventricular; SR, sinus rhythm.

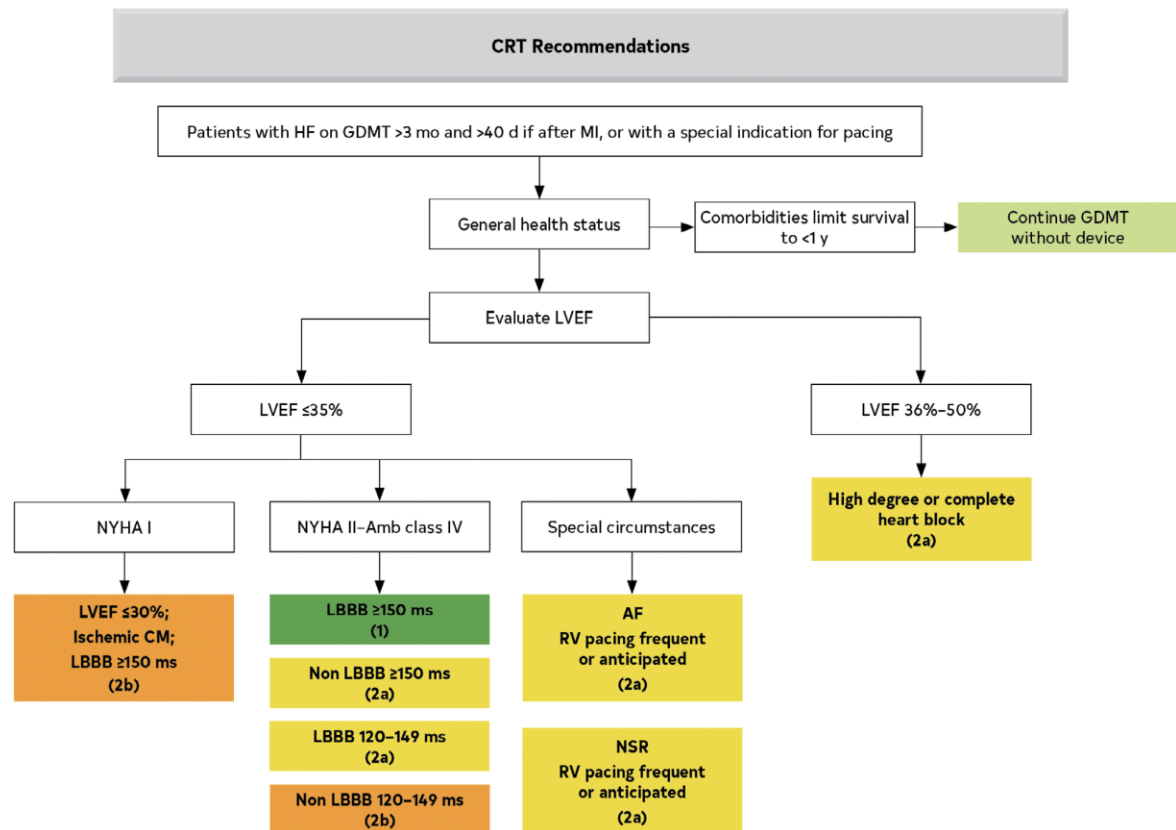


Figure 8. ACCF/AHA 2021 GL on HF. Algorithm for CRT Indications in Patients With Cardiomyopathy or HFrEF.

Recommendations for cardiac resynchronization therapy (CRT) are displayed.

AF indicates atrial fibrillation; Amb, ambulatory; CM, cardiomyopathy; GDMT, guideline-directed medical therapy; HB, heart block; HF, heart failure; HFrEF, heart failure with reduced ejection fraction; LBBB, left bundle branch block; LV, left ventricular; LVEF, left ventricular ejection fraction; NSR, normal sinus rhythm; NYHA, New York Heart Association; and RV, right ventricular.

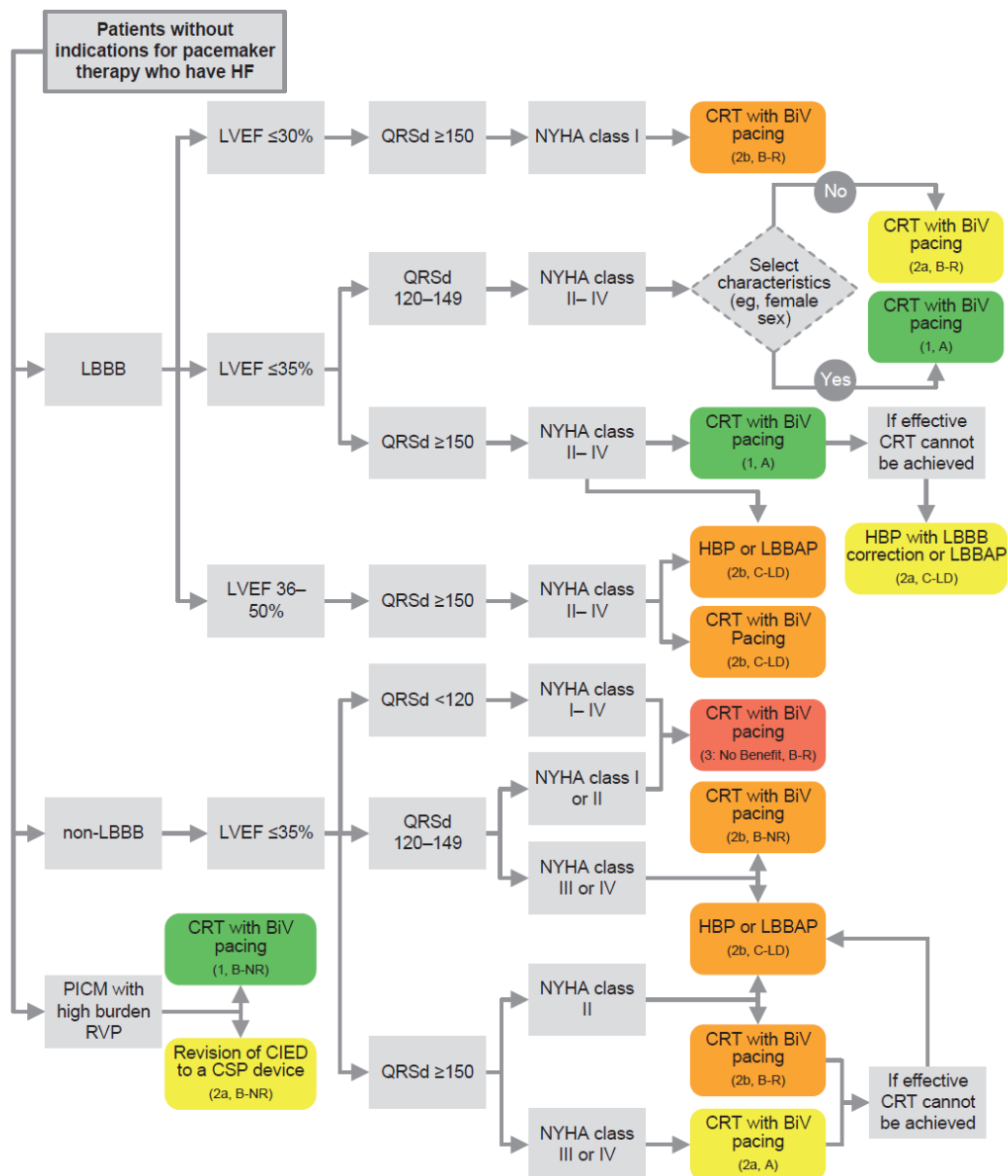


Figure 9. HRS/APHRS/LAHS 2023 guideline on cardiac physiologic pacing.

Algorithm for pacing strategies in patients without bradycardia indications who have HF.

BiV: biventricular; CIED: cardiovascular implantable electrical device; CRT: cardiac resynchronization therapy; HBP: His bundle pacing; HF: heart failure; LBBAP: left bundle branch area pacing; LBBB: left bundle branch block; LVEF: left ventricular ejection fraction; NYHA: New York Heart Association; PICM: pacing-induced cardiomyopathy; QRSd: QRS duration; RVP: right ventricular pacing.

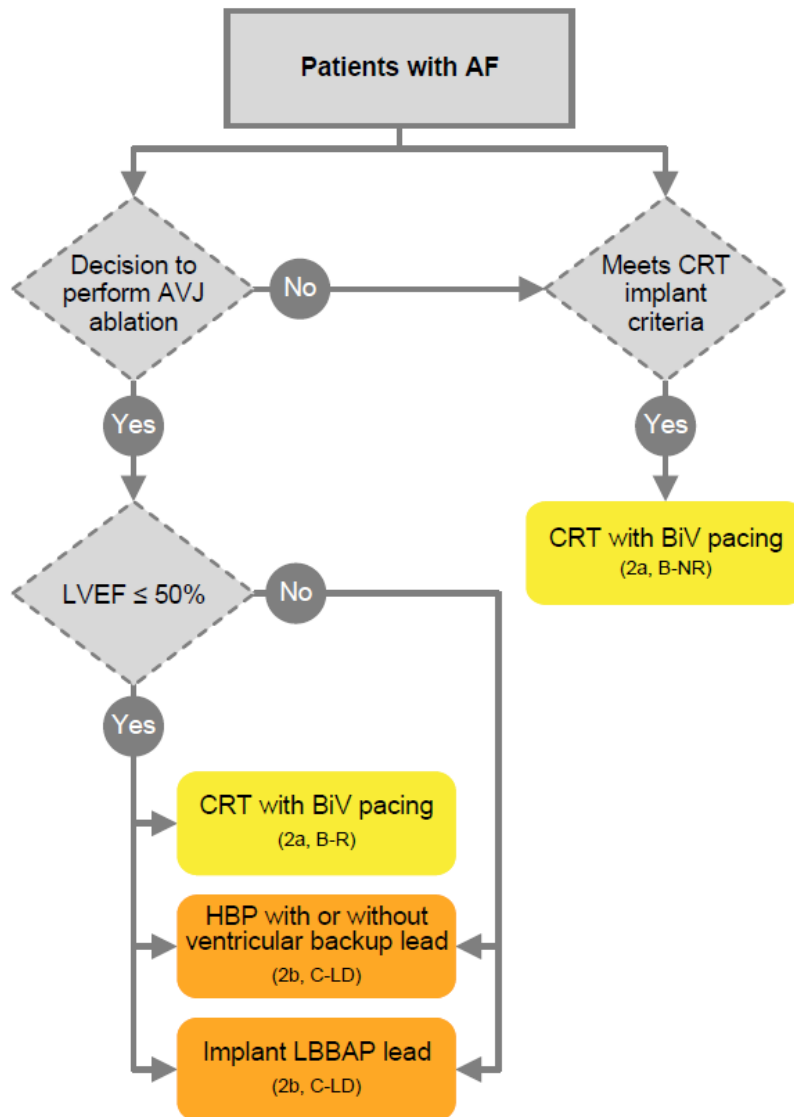


Figure 10. HRS/APHRS/LAHS 2023 guideline on cardiac physiologic pacing.

Algorithm for cardiac physiologic pacing in patients with atrial fibrillation.

AF: atrial fibrillation; AVJ: atrioventricular junction; BiV: biventricular; CRT: cardiac resynchronization therapy; HBP: His bundle pacing; LBBAP: left bundle branch area pacing; LVEF: left ventricular ejection fraction.

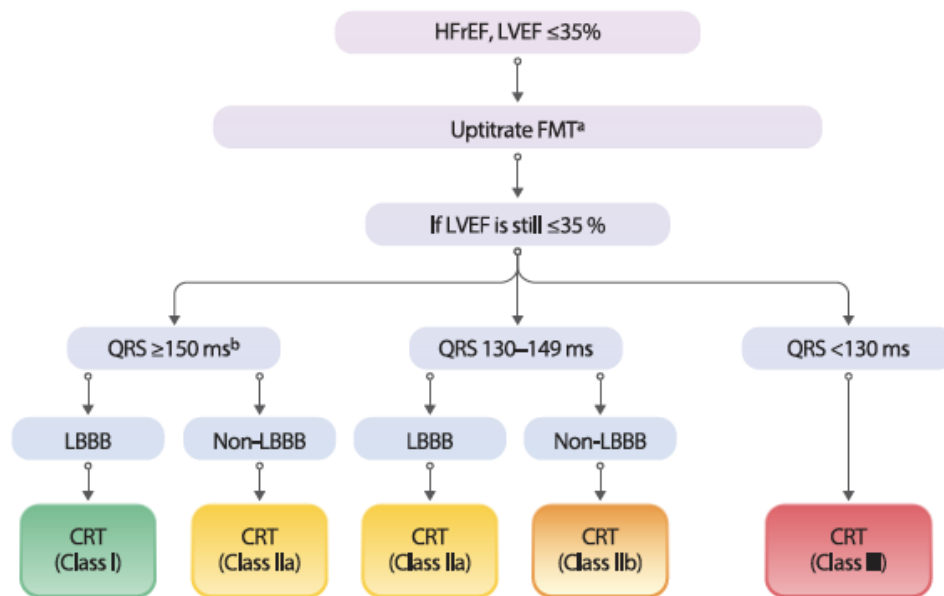


Figure 11. ESC 2026 GL on HF. Indications for cardiac resynchronization therapy in heart failure.

CRT, cardiac resynchronization therapy; FMT, foundational medical therapy; HFrEF, heart failure with reduced ejection fraction; ICD, Implantable cardioverter-defibrillator; LBBB, left bundle branch block; LVEF, left ventricular ejection fraction. In the decision on device implantation consider the following: patient preference, likely benefit of ICD/CRT at the patient's age, frailty and comorbidities, risk of complications, venous access issues.

^aUptitration to the highest tolerated doses of HFrEF FMT.

^bInitiation of FMT and planning for CRT implantation may be considered simultaneously in patients with symptomatic HFrEF, an LBBB with QRS ≥150 ms, and LVEF ≤35%, to improve symptoms and reduce morbidity and mortality, although reassessment of LVEF should be conducted prior to CRT implantation. (Class IIb).

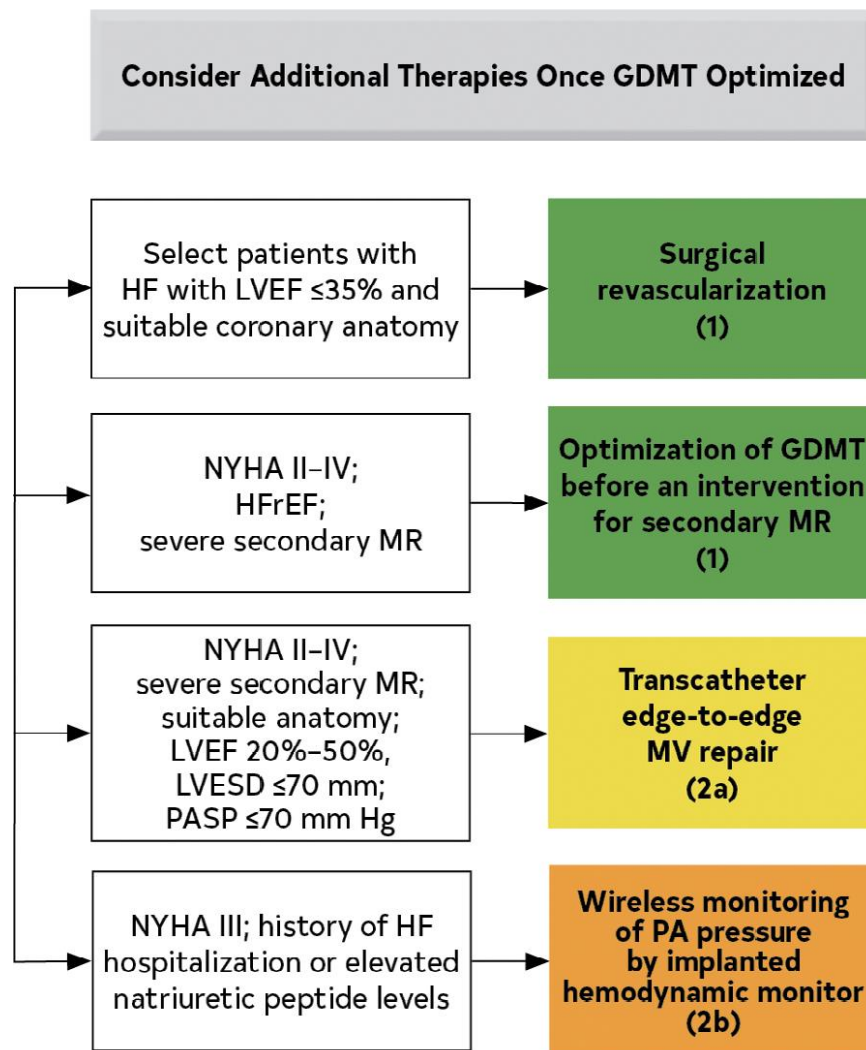


Figure 12. ACCF/AHA 2022 GL on HF. Additional Device Therapies.

Recommendations for additional nonpharmaceutical interventions that may be considered for patients with HF are shown.

GDMT indicates guideline-directed medical therapy; HF, heart failure; HFH, heart failure hospitalization; HFrEF, heart failure with reduced ejection fraction; IV, intravenous; LVEF, left ventricular ejection fraction; LVESD, left ventricular end systolic dimension; MV, mitral valve; MR, mitral regurgitation; NP, natriuretic peptide; NSR, normal sinus rhythm; NYHA, New York Heart Association; and PASP, pulmonary artery systolic pressure.

Table 12. Treatment of HFpEF

ESC 2021 GL on HF. Recommendations for the treatment of patients with heart failure with preserved ejection fraction

Screening for, and treatment of, aetiologies, and cardiovascular and non-cardiovascular Comorbidities is recommended in patients with HFpEF I C

Diuretics are recommended in congested patients with HFpEF in order to alleviate symptoms and signs. I C

ESC 2023 update on heart failure. Recommendation for the treatment of patients with symptomatic heart failure with preserved ejection fraction

An SGLT2 inhibitor (dapagliflozin or empagliflozin) in patients with HFpEF to reduce the risk of HF hospitalization or CV death I A

ACC/AHA/HFSA 2022 GL on HF. HF With Preserved Ejection Fraction

For patients with hypertension, medication titrated to attain blood pressure targets in accordance with published clinical practice guidelines to prevent morbidity. I C-LD

SGLT2i to decrease HF hospitalizations and cardiovascular mortality. IIa B-R

Management of AF to improve symptoms. IIa C-EO

MRAs to decrease hospitalizations, particularly among patients with LVEF on the lower end of this spectrum. IIb B-R

ARBs to decrease hospitalizations, particularly among patients with LVEF on the lower end of this spectrum. IIb B-R

ARNi to decrease hospitalizations, particularly among patients with LVEF on the lower end of this spectrum. IIb B-R

Routine use of nitrates or phosphodiesterase-5 inhibitors to increase activity or QOL is ineffective. III B-R
No benefit

ESC 2023 GI on diabetes. Recommendations for heart failure treatments in patients with diabetes and left ventricular ejection fraction over 40%

Empagliflozin or dapagliflozin are recommended in patients with T2DM and LVEF >40% (HFmrEF and HFpEF) to reduce the risk of HF hospitalization or CV death. ^{530–533}	I	A
Diuretics are recommended in patients with HFpEF or HFmrEF and diabetes with signs and/or symptoms of fluid congestion to improve symptoms, exercise capacity, and HF hospitalization. ⁵²⁰	I	C

CV, cardiovascular disease; HF, heart failure; HFmrEF, heart failure with mildly reduced ejection fraction; HFpEF, heart failure with preserved ejection fraction; LVEF, left ventricular ejection fraction; T2DM, type 2 diabetes mellitus.

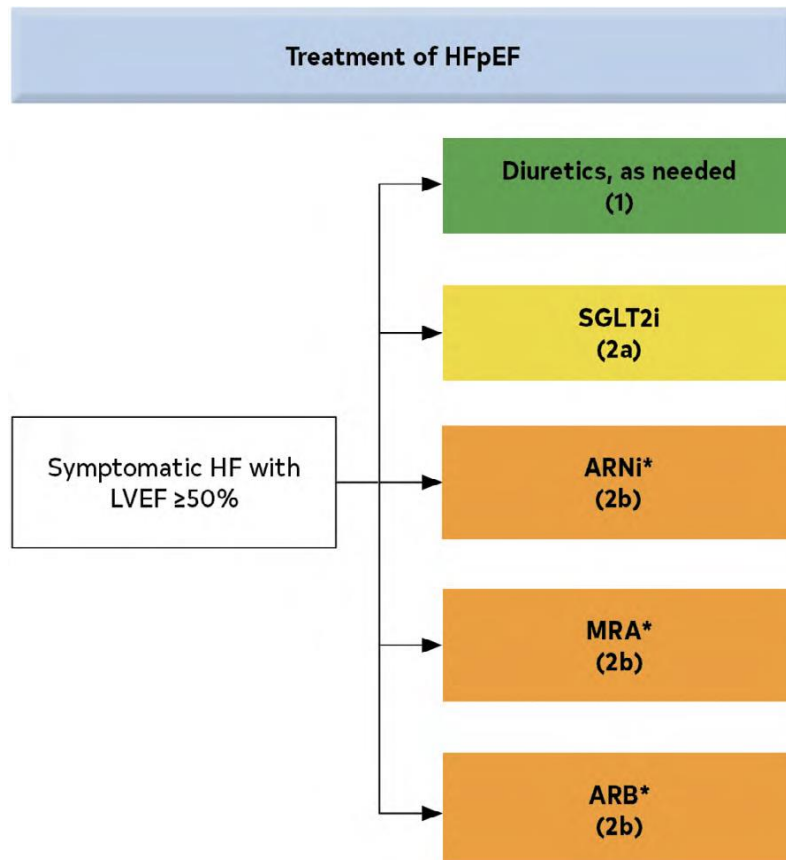


Figure 13. ACCF/AHA 2021 GL on HF. Recommendations for Patients With Preserved LVEF ($\geq 50\%$).

Medication recommendations for HFpEF are displayed.

ARB indicates angiotensin receptor blocker; ARNi, angiotensin receptor-neprilysin inhibitor; HF, heart failure; HFpEF, heart failure with preserved ejection fraction; LVEF, left ventricular ejection fraction; MRA, mineralocorticoid receptor antagonist; and SGLT2i, sodium-glucose cotransporter-2 inhibitor.

*Greater benefit in patients with LVEF closer to 50%.

Table 13. Heart failure in patients with coronary artery disease

ACC/AHA/HFSA 2022 GL on HF. Revascularization for CAD

In selected patients with HF, reduced EF (EF $\leq$ 35%), and suitable coronary anatomy, Surgical revascularization plus GDMT to improve symptoms, cardiovascular hospitalizations, and long-term all-cause mortality **I B-R**

ESC 2026 GL on HF. Recommendations for revascularization in chronic coronary syndrome in patients with heart failure

Revascularization for symptom improvement (HFpEF and HFrEF)		
Coronary revascularization is recommended in patients with HF, obstructive CAD, and persistent angina, despite FMT for HF and antianginal drugs, to relieve symptoms. ^{734,735}	I	C
Revascularization for outcome improvement (HFrEF)		
If revascularization is planned after assessment by a Heart Team, CABG should be considered as the preferred revascularization strategy, in patients with LVEF $\leq$ 35% and multivessel CAD suitable for surgery, to improve long-term survival. ¹⁸⁰	IIa	B1

CABG, coronary artery bypass grafting; CAD, coronary artery disease; FMT, foundational medical therapy; HF, heart failure; HFpEF, heart failure with preserved ejection fraction; HFrEF, heart failure with reduced ejection fraction; LVEF, left ventricular ejection fraction.

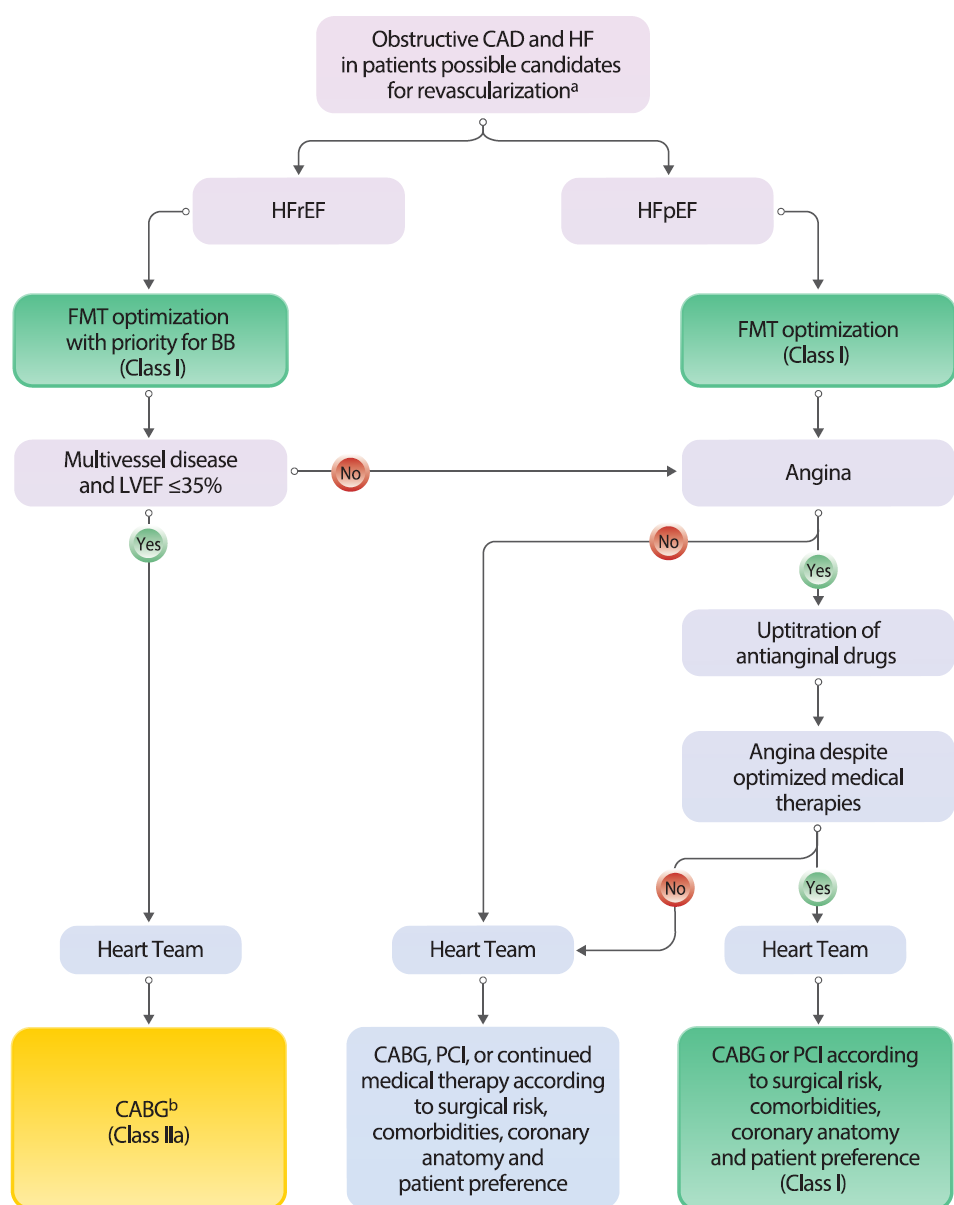


Figure 14. ESC 2026 GL on HF. Management of coronary artery disease in patients with heart failure.

BB, beta-blocker; CABG, coronary artery bypass grafting; CAD, coronary artery disease; FMT, foundational medical therapy; HF, heart failure; HFpEF, heart failure with preserved ejection fraction; HFrEF, heart failure with reduced ejection fraction; LVEF, left ventricular ejection fraction; PCI, percutaneous coronary intervention.

Colours refer to class of recommendation. ^aExclusion of frailty, severe and multiple comorbidities and limited life expectancy making the risk of revascularization higher than the expected benefit. ^bPCI or continued medical therapy are alternative treatments if the patient is not eligible for CABG.

Table 14. Atrial fibrillation in heart failure

ACC/AHA/HFSA 2022 GL on HF. Management of AF in HF.

Chronic anticoagulant therapy for patients with chronic HF with permanent-persistent-paroxysmal AF and a CHA2DS2-VASc score of ≥ 2 (for men) and ≥ 3 (for women).	I A
For patients with chronic HF with permanent-persistent-paroxysmal AF, DOAC is recommended over warfarin in eligible patients.	I A
For patients with HF and symptoms caused by AF, AF ablation to improve symptoms and QOL.	IIa B-R
For patients with AF and LVEF $\leq 50\%$, if a rhythm control strategy fails or is not desired, and ventricular rates remain rapid despite medical therapy, atrioventricular nodal ablation with implantation of a CRT device.	IIa B-R
For patients with chronic HF and permanent-persistent-paroxysmal AF, chronic anticoagulant therapy for men and women without additional risk factors.	IIa B-NR

ACC/AHA/ACCP/HRS 2023 guideline on AF. Management of AF in Patients With HF

In patients who present with a new diagnosis of HFrEF and AF, arrhythmia-induced cardiomyopathy should be suspected, and an early and aggressive approach to AF rhythm control is recommended.	1 B-NR
In appropriate patients with AF and HFrEF who are on GDMT, and with reasonable expectation of procedural benefit, catheter ablation to improve symptoms, QOL, ventricular function, and cardiovascular outcomes.	1 A
In appropriate patients with symptomatic AF and HFpEF with reasonable expectation of benefit, catheter ablation can be useful to improve symptoms and improve QOL.	2a B-NR
Digoxin for rate control, in combination with other rate-controlling agents or as monotherapy if other agents are not tolerated.	2a B-R
In patients with rapid ventricular rates in whom beta blockers or calcium channel blockers are contraindicated or ineffective, intravenous amiodarone for acute rate control (considering the risk of cardioversion and stroke).	2a B-NR

In patients with HFrEF (LVEF <50%), and refractory rapid ventricular response who are not candidates for or in whom rhythm control has failed, AVN ablation and biventricular pacing therapy to improve symptoms, QOL, and EF.	2a B-R
In patients with implanted biventricular pacing therapy in whom an effective pacing percentage cannot be achieved with pharmacological therapy, AVN ablation to improve functional class, reduce the risk of ICD shock, and improve survival.	2a B-NR
In patients with AF-induced cardiomyopathy who have recovered LV function, long-term surveillance to detect recurrent AF in view of the high risk of recurrence of arrhythmia-induced cardiomyopathy.	2a B-NR
In patients with suspected AF-induced cardiomyopathy or refractory HF symptoms undergoing pharmacological rate-control therapy for AF, a stricter rate-control strategy (target heart rate <80 bpm at rest and <110 bpm during moderate exercise).	2b B-NR
In patients with HFrEF who undergo AVNA, conduction system pacing of the His bundle or left bundle branch area as an alternative to biventricular pacing to improve symptoms, QOL, and LV function.	2b C-LD
In patients with known LVEF <40%, nondihydropyridine calcium channel–blocking drugs should not be administered because of their potential to exacerbate HF.	3 B-R Harm
Dronedarone should not be administered for maintenance of sinus rhythm to those with NYHA class III and IV HF or patients who have had an episode of decompensated HF in the past 4 weeks, due to the risk of increased early mortality associated with worsening HF.	3 B-R harm

ESC 2026 GL on HF. Recommendations for management of atrial fibrillation in patients with heart failure

Recommendations for anticoagulation		
Oral anticoagulation is recommended in patients with clinical AF at elevated thromboembolic risk, as determined by CHA ₂ DS ₂ -VA score ^c , to prevent ischaemic stroke and thromboembolism. ⁶³⁵	I	A
DOACs are recommended in preference to VKAs in patients with HF ^d to prevent stroke and thromboembolism. ^{643–646}	I	B1
Rate control		
Beta-blockers are recommended in stable patients with HFrEF and AF as first-line therapy for short- and long-term rate control. ^{663,665}	I	C
Digoxin should be considered in stable patients with HFrEF and AF when the ventricular rate remains high despite beta-blockers, or when beta-blockers are contraindicated/not tolerated, in order to obtain short- and long-term rate control. ^{665–667}	IIa	C
Atrioventricular node ablation combined with CRT should be considered in patients with severely symptomatic permanent AF and poor rate control despite medical therapy and at least one HFH to reduce symptoms, physical limitations, recurrent HFH, and death. ^{672,673}	IIa	B1
Intravenous amiodarone or digoxin may be considered in haemodynamically unstable patients with HFrEF and AF to stabilize the patient and achieve acute control of heart rate. ^{668–671}	IIb	C
Cardioversion		
Urgent cardioversion is recommended in the setting of DHF in patients presenting with rapid ventricular rates and haemodynamic instability to restore sinus rhythm. ^{669,671,692,695}	I	C
Atrial fibrillation catheter ablation		
Catheter ablation for AF should be considered in selected ^e patients with symptomatic AF and HFrEF to improve QoL and reduce the risk of HFH or death. ^{674–676,678,681,682,684,696}	IIa	C

AF, atrial fibrillation; CHA2DS2-VA, congestive heart failure, hypertension, age ≥ 75 years (2 points), diabetes mellitus, prior stroke/transient ischaemic attack/arterial thromboembolism (2 points), vascular disease, age 65–74 years; CRT, cardiac resynchronization therapy; DHF, decompensated heart failure; DOAC, direct-acting oral anticoagulant; HF, heart failure; HFH, heart failure hospitalization; HFrEF, heart failure with reduced ejection fraction; QoL, quality of life; VKA, vitamin K antagonist.

dExcept for patients with moderate or severe mitral stenosis and in patients with mechanical prosthetic heart valves where VKAs are recommended.

eAll the following criteria are required: high burden AF, less than 1-year duration for continuous persistent AF, clear cause–effect relationship between AF and HF.

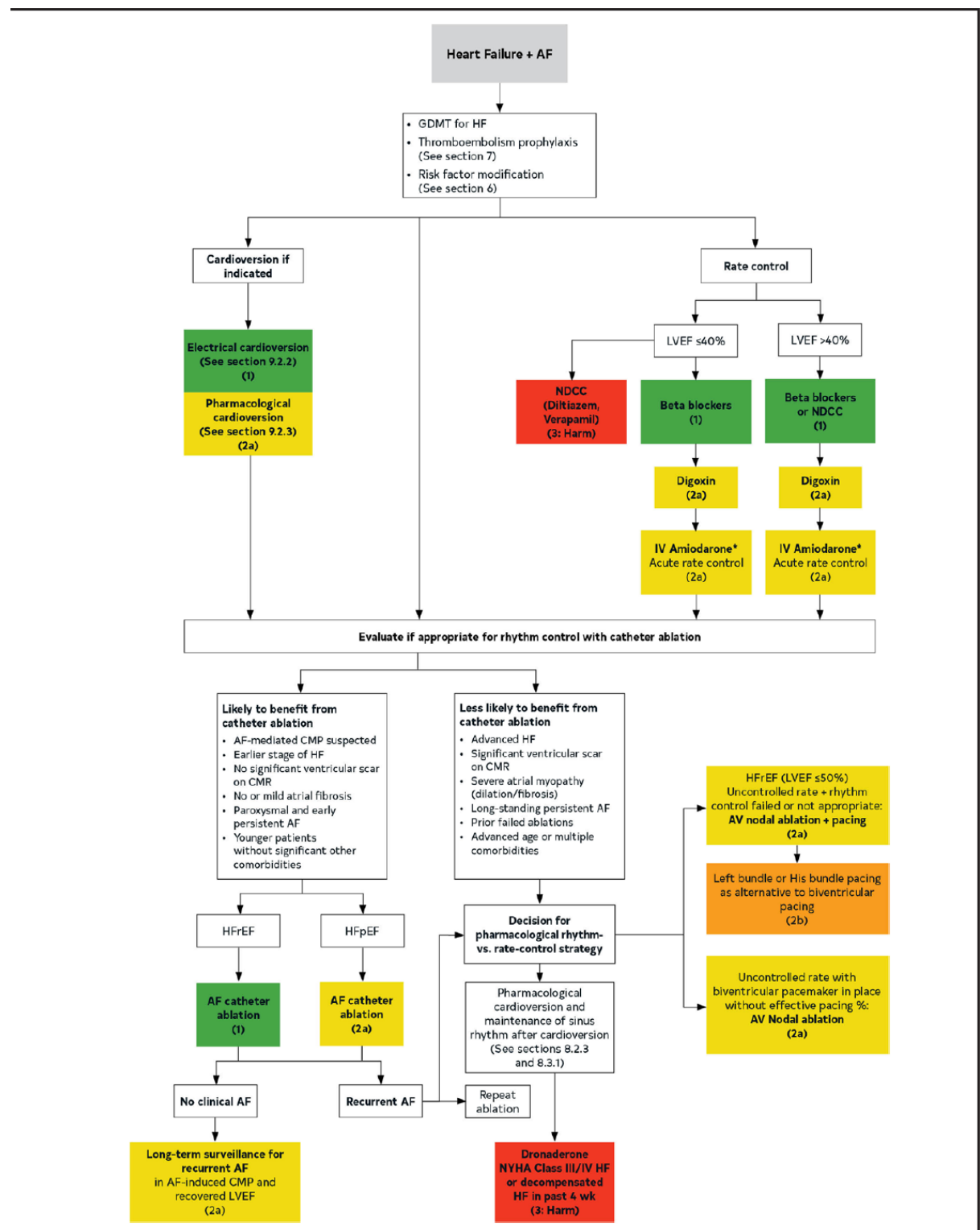


Figure 15. ACC/AHA/ACCP/HRS 2023 guideline on AF. Management of AF in Patients With HF

AF indicates atrial fibrillation; AV, atrioventricular; CMP, cardiomyopathy; CMR, cardiac magnetic resonance; GDMT, guideline-directed medical therapy; HF, heart failure; HFpEF, heart failure with preserved ejection fraction; HFrEF, heart failure with reduced ejection fraction; IV, intravenous; LVEF, left ventricular ejection fraction; NDCC, nondihydropyridine calcium channel blocker; and NYHA, New York Heart Association.

Overview of HF Management in CKM Syndrome Stage 4



Treat With First-Line GDMT for HF

- HFrEF: Beta blocker, steroidal MRA, ARNI/ACEi/ARB, SGLT2i, and diuretics as needed
- HFpEF: SGLT2i and diuretics as needed



Apply the Principles of CKM Management

- Promote cardiovascular health using Life's Essential 8 framework
- Facilitate interdisciplinary care, including CKM coordination point person
- Address adverse SDOH using CHW/social workers and leveraging community resources
- Manage blood pressure and lipids as per current guidelines

Manage CKM Syndrome Guided by Patient Risk Profile



For Patients With Obesity

- In HFpEF, initiate GLP-1–based therapy to improve functional capacity, symptoms, and HF outcomes
- In HFpEF, consider exercise training and caloric deficit diet to improve functional capacity
- In HFrEF, benefits of weight reduction and initiation of GLP-1–based therapies are uncertain



For Patients With T2D

- In HF, prioritize SGLT2i as first-line in cardioprotective glucose lowering
- In HFpEF and other CKM risk factors, consider addition of GLP-1–based therapy to improve symptoms and reduce CKM-related adverse outcomes



For Patients With CKD

- In HF and eGFR ≥ 30 , use ARNI/ACEi/ARB to improve HF and kidney outcomes
- In HF and eGFR ≥ 20 , use SGLT2i to improve HF and kidney outcomes
- In HFmrEF/HFpEF, T2D, eGFR ≥ 25 , and UACR ≥ 30 mg/g, consider finerenone to improve HF and kidney outcomes

Figure 16. AHA/ACC 2026 Guideline on Cardiovascular-Kidney-Metabolic Syndrome
Overview of Management Principles for CKM Syndrome

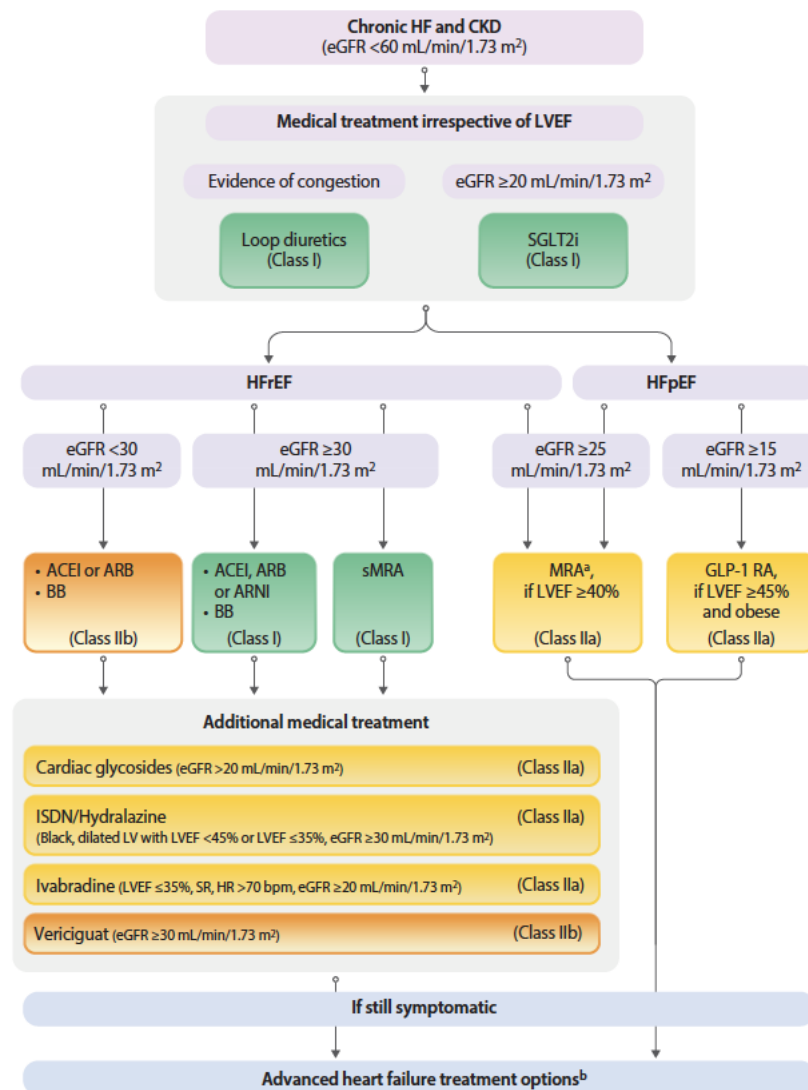


Figure 17. ESC 2026 GL on CKD. Pharmacological treatment of patients with heart failure and chronic kidney disease.

ACEI, angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blocker; ARNI, angiotensin receptor/neprilysin inhibitor; BB, beta-blocker; CKD, chronic kidney disease; eGFR, estimated glomerular filtration rate; GLP-1RA, glucagon-like peptide 1 receptor agonist; HF, heart failure; HFpEF, heart failure with preserved ejection fraction; HFrEF, heart failure with reduced ejection fraction; HR, heart rate; ISDN, isosorbide dinitrate; LV, left ventricle; LVEF, left ventricular ejection fraction; SGLT2i, sodium glucose co-transporter 2 inhibitor; (s)MRA, (steroidal) mineralocorticoid receptor antagonist; SR, sinus rhythm. ^aEither steroidal or non-steroidal MRA. For steroidal MRA: eGFR ≥30 mL/min/1.73 m².

Table 15. ESC 2026 GL on CKD.

Recommendations for treatment of chronic heart failure in patients with chronic kidney disease

Treatment irrespective of LVEF		
Treatment with loop diuretics is recommended in patients with HF and CKD to alleviate symptoms/signs of fluid overload and improve exercise capacity. ^{381,382}	I	A
Treatment with an SGLT2 inhibitor is recommended in patients with HF and CKD with eGFR ≥ 20 mL/min/1.73 m ² irrespective of LVEF, to reduce the risk of (repeated) HF hospitalization and cardiovascular death. ^{297–304}	I	A
Treatment with a steroidal MRA is recommended in patients with HF and CKD with an eGFR ≥ 30 mL/min/1.73 m ² and HFrEF, to reduce the risk of HF hospitalization and death. ^{307,308,313,326,327}	I	A
Treatment with a MRA, either steroidal or non-steroidal, should be considered in patients with HF with LVEF $\geq 40\%$ and CKD with an eGFR ^c ≥ 25 mL/min/1.73 m ² to reduce the risk of HF hospitalization and cardiovascular death. ^{307,311}	IIa	B1
HFrEF		
Treatment with either ACEI, ARNI, or ARB (if ACEI or ARNI not tolerated) is recommended in patients with HFrEF and CKD with an eGFR ≥ 30 mL/min/1.73 m ² to reduce the risk of HF hospitalization and death. ^{315,316,318,321–323,338}	I	A
Treatment with an ACEI is recommended in patients with CKD with an eGFR ≥ 30 mL/min/1.73 m ² and asymptomatic left ventricular dysfunction (LVEF $\leq 35\%$) to reduce the risk of incident HF and HF-related hospitalizations. ³¹⁷	I	B1
Treatment with a beta-blocker is recommended in patients with HFrEF and CKD with an eGFR ≥ 30 mL/min/1.73 m ² to reduce the risk of HF hospitalization and death. ^{332,333,335,336}	I	A
Treatment with an ARNI (sacubitril/valsartan) should be considered in patients with HFrEF and CKD with an eGFR ≥ 30 mL/min/1.73 m ² as an alternative to ACEI/ARB to reduce the risk of CKD progression (or slow the decline in eGFR). ^{322,323}	IIa	B1
Treatment with a combination of hydralazine-isosorbide dinitrate should be considered in self-identified Black patients with HFrEF and CKD with an eGFR ≥ 30 mL/min/1.73 m ² and dilated left ventricle in combination with LVEF $<45\%$, or LVEF $\leq 35\%$, when added to conventional HFrEF therapy to reduce the risk of HF hospitalization and death. ^{351,352}	IIa	C
Treatment with an ACEI or ARB may be considered in patients with HFrEF and CKD with an eGFR 15–29 mL/min/1.73 m ² to reduce the risk of HF hospitalization and cardiovascular death. ^{315–318,320,321,338,339}	IIb	C
Treatment with a beta-blocker may be considered in patients with HFrEF and CKD with an eGFR 15–29 mL/min/1.73 m ² to reduce the risk of HF hospitalization and death. ³³⁵	IIb	C
Additional medical therapy in HFrEF		
Additional medical therapy with cardiac glycosides (digoxin or digitoxin) should be considered in patients with HFrEF and CKD with eGFR >20 mL/min/1.73 m ² to reduce the risk of HF hospitalization and death. ^{342–344,349,350}	IIa	B1
Additional medical therapy with vericiguat may be considered in patients with HFrEF and CKD with eGFR ≥ 30 mL/min/1.73 m ² to reduce the risk of HF hospitalization and cardiovascular death. ^{347–350}	IIb	B1
Additional medical therapy with ivabradine ^d should be considered in patients with HFrEF and CKD with eGFR ≥ 20 mL/min/1.73 m ² to reduce the risk of cardiovascular and HF-related events. ^{345,346}	IIa	B1
HFpEF		
Treatment with a GLP-1RA (semaglutide) or glucose-dependent insulinotropic polypeptide and GLP-1RA (tirzepatide) should be considered in patients with HFpEF and CKD with an eGFR ≥ 15 mL/min/1.73 m ² and LVEF $\geq 45\%$ with or without diabetes who are obese, to reduce weight and improve quality of life. ^{353–355,357}	IIa	B1

ACEI, angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blocker; ARNI, angiotensin receptor-neprilysin inhibitor; CKD, chronic kidney disease; eGFR, estimated glomerular filtration rate; GLP-1RA, glucagon-like peptide-1 receptor agonist; HF, heart failure; HFrEF, heart failure with reduced ejection fraction; HFpEF, heart failure with preserved ejection fraction; LVEF, left ventricular ejection fraction; MRA, mineralocorticoid receptor antagonist; SGLT2, sodium glucose co-transporter 2.

cSteroidal MRA: eGFR >30 mL/min/1.73 m².

dLVEF $\leq 35\%$, sinus rhythm, heart rate >70 b.p.m.

Recommendations for management of comorbidities in patients with heart failure and chronic kidney disease

Iron deficiency		
Treatment with intravenous iron supplementation should be considered in patients with HFrEF and CKD with iron deficiency ^c to reduce the risk of HF hospitalization. ^{358,360,361,363,366}	IIa	B1

CKD, chronic kidney disease; HF, heart failure; HFrEF, heart failure with reduced ejection fraction; TSAT, transferrin saturation.

cDefined as serum ferritin <100 ng/mL or serum ferritin 100–299 ng/mL with TSAT $<20\%$.

Recommendations for management of heart failure therapy in the context of a drop in estimated glomerular filtration rate

Chronic heart failure		
Continuation of a SGLT2 inhibitor should be considered in patients with HF and CKD in whom the eGFR progresses to <20 mL/min/1.73 m ^{2,c} to avoid worsening of HF. ^{414,415}	Ila	C
Continuation of an ARNI should be considered in patients with HF and CKD in whom the eGFR progresses to <30 mL/min/1.73 m ^{2,c} to avoid worsening of HF. ³⁴⁰	Ila	C

cOverall eGFR drop needs to be <50% without hyperkalaemia >5.5 mmol/L.

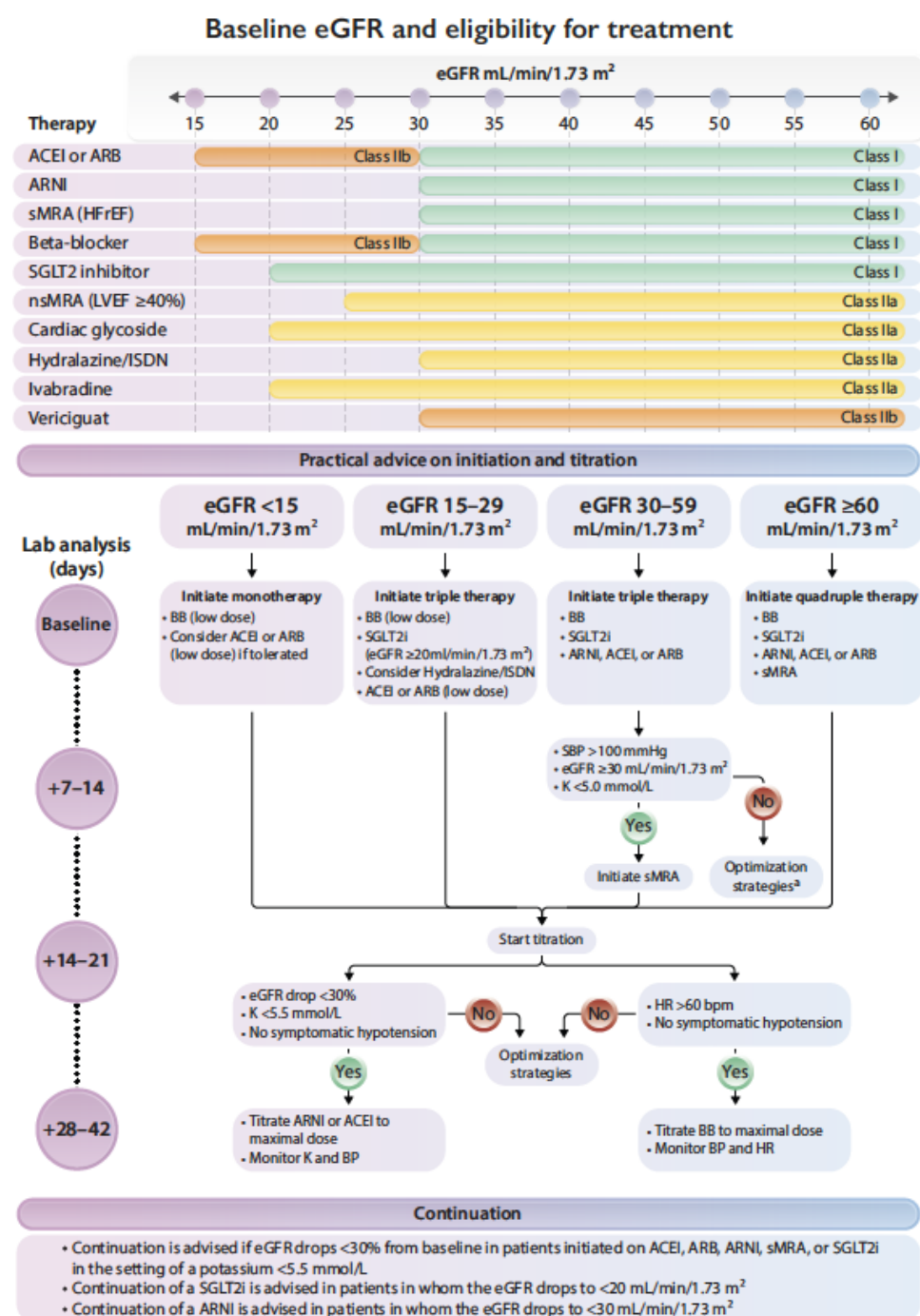


Figure 18. ESC 2026 GL on CKD. Monitoring kidney function in the treatment of chronic heart failure with reduced ejection fraction and chronic kidney disease.

ACEI, angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blocker; ARNI, angiotensin receptor/neprilysin inhibitor; BB, Beta-blocker; BP, blood pressure; ECG, electrocardiogram; eGFR, estimated glomerular filtration rate; HR, heart rate; ISDN, isosorbide dinitrate; K, potassium; MRA, mineralocorticoid receptor antagonist; (ns)MRA, (non-steroidal) mineralocorticoid receptor antagonist; SBP, systolic blood pressure; SGLT2i, sodium glucose co-transporter 2 inhibitor.

aOptimization strategies: (i) Low BP: stop other BP-lowering agents, assess volume status, possible low output state, (ii) Low eGFR: stop nephrotoxins, consider renal work-up (e.g. consider renal artery stenosis), (iii) Hyperkalaemia: if very high, perform ECG, consider lab mistake, stop potassium supplements, assess volume status, consider potassium binder, (iv) Low HR (<50 b.p.m.): perform ECG, consider stopping other HR-slowing drugs, take adequate measures if high degree atrioventricular block.

Table 16. Cancer and heart failure

ESC 2021 GL on HF. Drugs causing heart failure

Cancer therapy	Indication
Anthracycline chemotherapy (doxorubicin, epirubicin, daunorubicin, idarubicin)	Breast cancer, lymphoma, acute leukaemia, sarcoma
HER2-targeted therapies (trastuzumab, pertuzumab, trastuzumab emtansine T-DM1, lapatinib, neratinib, tucatinib)	HER2+ breast cancer HER2+ gastric cancer
VEGF inhibitors TKIs (sunitinib, pazopanib, sorafenib, axitinib, tivozanib, cabozantinib, regorafenib, lenvatinib, vandetanib) and antibodies (bevacizumab, ramucirumab)	VEGF TKIs: renal cancer, hepatocellular cancer, thyroid cancer, colon cancer, sarcoma, GIST Antibodies: breast cancer, ovarian cancer, gastric cancer, gastro-oesophageal cancer, colon cancer
Multi-targeted kinase inhibitors: second and third generation BCR-ABL TKIs (ponatinib, nilotinib, dasatinib, bosutinib)	Chronic myeloid leukaemia
Proteasome inhibitors (carfilzomib, bortezomib, ixazomib)	Multiple myeloma
Immunomodulatory drugs (lenalidomide, pomalidomide)	
Combination RAF and MEK inhibitors (dabrafenib+trametinib, vemurafenib+cobimetinib, encorafenib+binimetinib)	RAF mutant melanoma
Androgen deprivation therapies GnRH agonists (goserelin, leuporelin) Antiandrogens (abiraterone)	Prostate cancer, breast cancer
Immune checkpoint inhibitors: anti-programmed cell death 1 inhibitors (nivolumab, pembrolizumab) anti-cytotoxic T-lymphocyte-associated protein 4 inhibitor (ipilimumab) anti-programmed death-ligand 1 inhibitors (avelumab, atezolizumab, durvalumab)	Melanoma (metastatic and adjuvant) Metastatic renal cancer, non-small cell lung cancer, small cell lung cancer, refractory Hodgkin's lymphoma, metastatic triple negative breast cancer, metastatic urothelial cancer, liver cancer, MMR-deficient cancer

GIST = gastrointestinal stromal tumour; GnRH = gonadotropin-releasing hormone; HER2 = human epidermal growth factor receptor 2; MEK = mitogen-activated protein kinase; MMR = mismatch repair; TKI = tyrosine kinase inhibitor; VEGF = vascular endothelial growth factor.

ESC 2021 GL on HF. Recommendations for the management of patients with cancer and heart failure

Cancer patients at increased risk for cardiotoxicity, defined by a history or risk factors of CV disease, previous cardiotoxicity or exposure to cardiotoxic agents, undergo CV evaluation before scheduled anticancer therapy, preferably by a cardiologist with experience/interest in Cardio-Oncology. I C

Treatment with an ACE-I and a beta-blocker (preferably carvedilol) in IIa B

cancer patients developing LV systolic dysfunction, defined as a 10% or more decrease in LVEF and to a value lower than 50%, during anthracycline chemotherapy.

A baseline CV risk assessment in all cancer patients scheduled to receive a cancer treatment with the potential to cause heart failure. IIa C

ACE-I = angiotensin-converting enzyme inhibitor; CV = cardiovascular; LV = left ventricular; LVEF = left ventricular ejection fraction.

ESC 2022 GL on cardio-oncology. Recommendations for adult cancer survivors who develop cancer therapy-related cardiac dysfunction late after cardiotoxic cancer therapy

ACE-I/ARB and/or beta-blockers in adult CS with moderate asymptomatic CTRCD.^a I C

ACE-I/ARB and/or beta-blocker in adult CS with mild asymptomatic CTRCD.^b IIb C

ACE-I, angiotensin-converting enzyme inhibitors; ARB, angiotensin receptor blockers; CS, cancer survivors; CTRCD, cancer therapy-related cardiac dysfunction; GLS, global longitudinal strain; LVEF, left ventricular ejection fraction.

a New LVEF reduction by ≥ 10 percentage points to an LVEF of 40–49% OR new LVEF reduction by < 10 percentage points to an LVEF of 40–49% AND either new relative decline in GLS by $> 15\%$ from baseline OR new rise in cardiac biomarkers.

b LVEF $\geq 50\%$ and new relative decline in GLS by $> 15\%$ from baseline AND/OR new rise in cardiac biomarkers.

ACC/AHA/HFSA 2022 GL on HF. Recommendations for Cardio-Oncology

In patients who develop cancer therapy–related cardiomyopathy or HF, a multidisciplinary discussion involving the patient about the risk-benefit ratio of cancer therapy interruption, discontinuation, or continuation to improve management. I B-NR

In asymptomatic patients with cancer therapy-related cardiomyopathy (EF $< 50\%$), ARB, ACEi, and beta blockers to prevent progression to HF and improve cardiac function. IIa B-NR

In patients with cardiovascular risk factors or known cardiac disease being considered for potentially cardiotoxic anticancer therapies, pretherapy evaluation of cardiac function to establish baseline cardiac function and guide the choice of cancer therapy. IIa B-NR

In patients with cardiovascular risk factors or known cardiac disease receiving potentially cardiotoxic anticancer therapies, monitoring of cardiac function for the early identification of drug-induced cardiomyopathy. IIa B-NR

In patients at risk of cancer therapy–related cardiomyopathy, IIb B-R

initiation of beta blockers and ACEi/ARB for the primary prevention of drug-induced cardiomyopathy is of uncertain benefit.

In patients being considered for potentially cardiotoxic therapies, serial measurement of cardiac troponin for further risk stratification. IIb C-LD

ACC/AHA/HFSA 2022 GL on HF. Cancer Therapies Known to Be Associated With Cardiomyopathy

Class	Agent(s)	Cardiac Function Monitoring Often Performed in Clinical Practice	
		Pretherapy	Serial
Anthracyclines ^{55–57}	Doxorubicin, epirubicin	X	X
Alkylating agents ^{58–60}	Cyclophosphamide, ifosfamide, melphalan	X	
Antimicrotubule agents ^{61,62}	Docetaxel		
Antimetabolites ^{63–72}	Fluorouracil, capecitabine, fludarabine, decitabine		
Anti-HER2 agents ^{73–76}	Trastuzumab, pertuzumab	X	X
Monoclonal antibodies ⁷⁷	Rituximab		
Tyrosine-kinase inhibitors ^{78–100}	Dabrafenib, dasatinib, lapatinib, pazopanib, ponatinib, sorafenib, trametinib, sunitinib, vandetanib, imatinib, vandetanib		
Immune checkpoint inhibitors ^{99,101,102}	Nivolumab, ipilimumab, pembrolizumab		
Protease inhibitors ^{103–106}	Bortezomib, carfilzomib		
Endocrine therapy ^{107–111}	Goserelin, leuprolide, flutamide, bicalutamide, nilutamide		
Chimeric antigen receptor T-cell therapy ^{112,113}	Tisagenlecleucel, axicabtagene ciloleucel	X	
Hematopoietic stem cell transplantation ^{114,115}	Hematopoietic stem cell transplantation	X	
Radiation ^{116,117}	Chest		

ACC/AHA/HFSA 2022 GL on HF. Risk Factors for Cancer Therapy–Related Cardiomyopathy

Age ≥60 y
Black race
CAD
Hypertension
Diabetes
Preexisting cardiomyopathy
Previous exposure to anthracyclines
Previous chest radiation
Elevated troponin pretherapy

Table 17. Treatment of co-morbidities in patients with heart failure

ESC 2021 GL on HF. Recommendations for the treatment of diabetes in heart failure

SGLT2 inhibitors (canagliflozin, dapagliflozin, empagliflozin, ertugliflozin, sotagliflozin) I A
in patients with T2DM at risk of CV events to reduce hospitalizations for HF, major
CV events, end-stage renal dysfunction, and CV death.

SGLT2 inhibitors (dapagliflozin, empagliflozin, and sotagliflozin) I A
in patients with T2DM and HFrEF to reduce hospitalizations for HF and CV death.

CV = cardiovascular; HF = heart failure; HFrEF = heart failure with reduced ejection
fraction; SGLT2 = sodium-glucose co-transporter 2; T2DM = type 2 diabetes
mellitus.

ACC/AHA/HFSA 2022 GL on HF. Most Common Co-Occurring Chronic Conditions Among Medicare Beneficiaries With HF (N=4 947 918), 2011

Beneficiaries Age ≥65 y (n=4 376 150)*			Beneficiaries Age <65 y (n=571 768)†		
	n	%		n	%
Hypertension	3 685 373	84.2	Hypertension	461 235	80.7
Ischemic heart disease	3 145 718	71.9	Ischemic heart disease	365 889	64.0
Hyperlipidemia	2 623 601	60.0	Diabetes	338 687	59.2
Anemia	2 200 674	50.3	Hyperlipidemia	325 498	56.9
Diabetes	2 027 875	46.3	Anemia	284 102	49.7
Arthritis	1 901 447	43.5	CKD	257 015	45.0
CKD	1 851 812	42.3	Depression	207 082	36.2
COPD	1 311 118	30.0	Arthritis	201 964	35.3
AF	1 247 748	28.5	COPD	191 016	33.4
Alzheimer's disease or dementia	1 207 704	27.6	Asthma	88 816	15.5

Data source: Centers for Medicare & Medicaid Services administrative claims data, January 2011 to
December 2011, from the Chronic Condition Warehouse (CCW), ccwdata.org.

AF indicates atrial fibrillation; CKD, chronic kidney disease; COPD, chronic obstructive pulmonary disease; and
HF, heart failure.

*Mean No. of conditions is 6.1; median is 6.

†Mean No. of conditions is 5.5; median is 5.

ACC/AHA/HFSA 2022 GL on HF. Management of Comorbidities in Patients With HF

Management of Anemia or Iron Deficiency

In patients with HFrEF and iron deficiency with or without anemia, intravenous iron replacement to improve functional status and QOL. IIa B-R

In patients with HF and anemia, erythropoietin stimulating agents should not be used to improve morbidity and mortality. III B-R

Management of Hypertension

In patients with HFrEF and hypertension, uptitration of GDMT to the maximally tolerated target dose. I C-LD

Management of Sleep Disorders

In patients with HF and suspicion of sleep-disordered breathing, a formal sleep assessment to confirm the diagnosis and differentiate between obstructive and central sleep apnea.^{9,10} IIa C-LD

In patients with HF and obstructive sleep apnea, continuous positive airway pressure may be reasonable to improve sleep quality and decrease daytime sleepiness.^{9,11–13} IIa B-R

In patients with NYHA class II to IV HFrEF and central sleep apnea, adaptive servo-ventilation causes harm. III B-R
Harm

Management of Diabetes

In patients with HF and type 2 diabetes, use of SGLT2i for the management of hyperglycemia and to reduce HF-related morbidity and mortality I A

ESC 2026 GL on HF. Comorbidities in HF.

Recommendations for obesity in patients with heart failure

Semaglutide or tirzepatide should be considered for patients with symptomatic HF, LVEF $\geq 45\%$, and BMI ≥ 30 kg/m ² , regardless of diabetes status, to reduce body weight, and improve exercise capacity and QoL. ^{315–317,819,820,825}	IIa	B1
Bariatric surgery may be considered in obese patients with HF and a BMI ≥ 35 kg/m ² to reduce body weight when repetitive and structured lifestyle changes combined with weight-reducing medications do not result in maintained weight loss. ^{823,824}	IIb	C

BMI, body mass index; HF, heart failure; LVEF, left ventricular ejection fraction; QoL, quality of life.

Recommendations for iron deficiency in patients with heart failure

Intravenous iron supplementation is recommended in patients with symptomatic HFrEF and iron deficiency to alleviate HF symptoms and improve QoL. ⁸⁷⁵⁻⁸⁷⁹	I	B1
Intravenous iron supplementation should be considered in patients with symptomatic HFrEF and iron deficiency to reduce the risk of HFH. ^{872-874,879,881,885,886,888}	IIa	B1

HF, heart failure; HFH, heart failure hospitalization; HFrEF, heart failure with reduced ejection fraction; QoL, quality of life.

Recommendations for lung disease and sleep-disordered breathing

Adaptive servo-ventilation may be considered in patients with HFrEF and sleep-disordered breathing with predominant obstructive sleep apnoea to improve sleep quality, health-related QoL and symptoms. ⁹⁰⁵	IIb	C
Adaptive servo-ventilation is not recommended in patients with HFrEF and sleep-disordered breathing with predominant central sleep apnoea because of an increased risk of CV and all-cause death. ⁹⁰⁴	III	A

CV, cardiovascular; HFrEF, heart failure with reduced ejection fraction; QoL, quality of life.

Recommendations for anxiety, depression, and frailty

Assessment of anxiety, depression and frailty should be considered in patients with HF to support the development of personalized care plans and to identify factors that may contribute to adverse outcomes. ^{909,914,915,920,923}	IIa	C
--	-----	---

Recommendations for other non-cardiovascular comorbidities

Influenza and pneumococcal vaccination should be considered in patients with HF to reduce the risk of pneumonia complications, hospitalization, and death. 931-934,936,953,954	Ila	C
NSAIDs and COX-2 inhibitors are not recommended in patients with HF as they increase the risk of HF worsening and HFH. 942,946-948	III	B2

COX-2, cyclooxygenase-2; HF, heart failure; HFH, heart failure hospitalization; NSAID, non-steroidal anti-inflammatory drug.

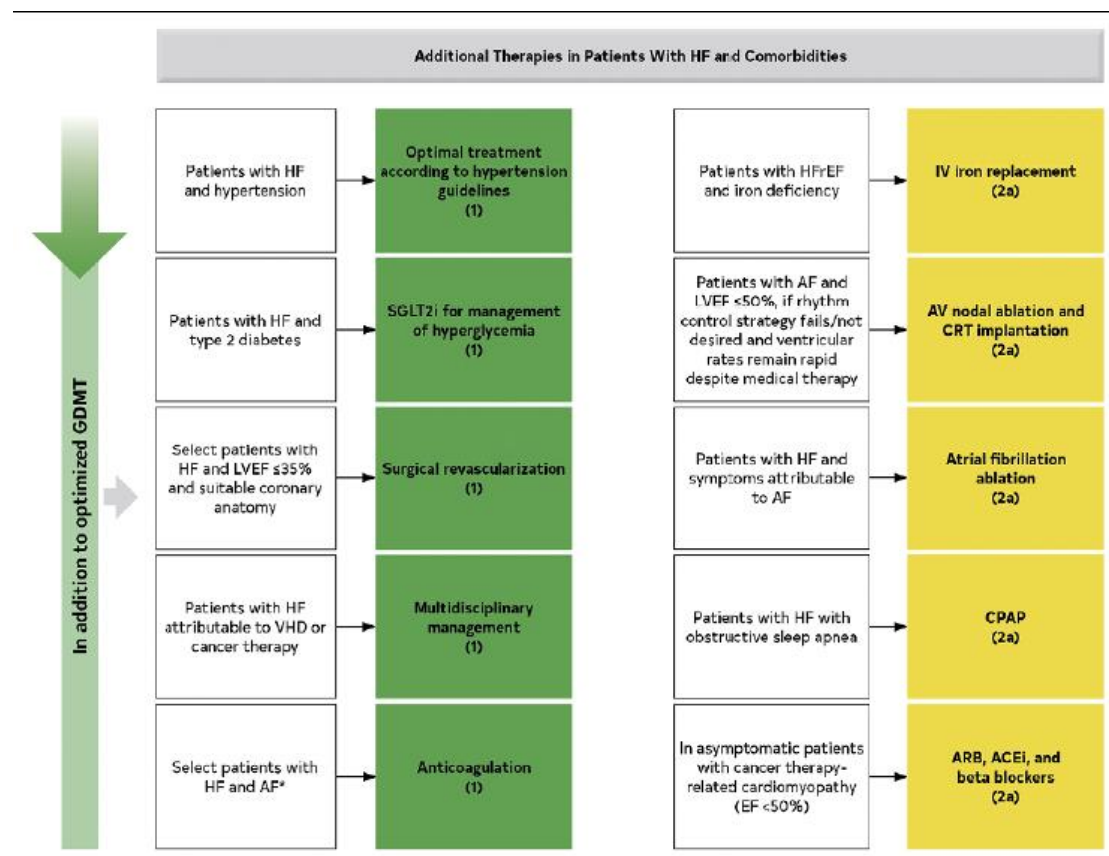


Figure 19. ACCF/AHA 2021 GL on HF. Recommendations for Treatment of Patients With HF and Selected Comorbidities.

ACEi indicates angiotensin-converting enzyme inhibitor; AF, atrial fibrillation; ARB, angiotensin receptor blocker; AV, atrioventricular; CHA2DS2-VASc, congestive heart failure, hypertension, age ≥75 years, diabetes mellitus, stroke or transient ischemic attack [TIA], vascular disease, age 65 to 74 years, sex category; CPAP, continuous positive airway pressure; CRT, cardiac resynchronization therapy; EF, ejection fraction; GDMT, guideline-directed medical therapy; HF, heart failure; HFrEF, heart failure with reduced ejection fraction; IV, intravenous; LVEF, left ventricular ejection fraction; NYHA, New York Heart Association; SGLT2i, sodium-glucose cotransporter-2 inhibitor; and VHD, valvular heart disease.

*Patients with chronic HF with permanent-persistent-paroxysmal AF and a CHA2DS2-VASc score of ≥2 (for men) and ≥3 (for women).

Table 18. Advanced HF

ESC 2026 GL on HF. Criteria for definition of advanced heart failure

All the following criteria must be present despite FMT, AMT, and GDIT:
1. Severe and persistent symptoms of HF (NYHA class III or IV).
2. Severe cardiac dysfunction defined by at least one of the following: • LVEF $\leq 30\%$ • Isolated RV failure (e.g. ARVC) • Non-operable severe valve abnormalities • Non-operable severe congenital abnormalities • Persistently high (or increasing) BNP or NT-proBNP values and severe LV diastolic dysfunction or structural abnormalities (i.e. HFpEF,^a hypertrophic or restrictive cardiomyopathies).
3. Episodes of pulmonary or systemic congestion requiring high-dose i.v. diuretics (or diuretic combinations) or malignant arrhythmias causing ≥ 2 unplanned visits or hospitalizations in the last 12 months, or ≥ 1 episode of low output requiring inotropes or vasoactive drugs.
4. Severe impairment of exercise capacity with inability to exercise, or low 6-min walk test distance (< 300 m), or $pVO_2 < 12\text{--}14$ mL/kg/min, ^b or $< 50\%$ predicted value, estimated to be of cardiac origin.

AMT, additional medical therapy; ARVC, arrhythmogenic right ventricular cardiomyopathy; BNP, B-type natriuretic peptide; FMT, foundational medical therapy; GDIT, guideline-directed interventional therapy; HF, heart failure; HFpEF, heart failure with preserved ejection fraction; i.v., intravenous; LV, left ventricular; LVEF, left ventricular ejection fraction; NT-proBNP, N-terminal pro-B-type natriuretic peptide; NYHA, New York Heart Association; pVO_2 , peak oxygen consumption; RV, right ventricular.

^aSee [Table 10](#).

^bThe cut-off 12 mL/kg/min refers to patients on beta-blocker.

ACC/AHA/HFSA 2022 GL on HF. Clinical Indicators of Advanced HF.

- Repeated hospitalizations or emergency department visits for HF in the past 12 mo.
- Need for intravenous inotropic therapy.
- Persistent NYHA functional class III to IV symptoms despite therapy.
- Severely reduced exercise capacity (peak VO_2 , < 14 mL/kg/min or $< 50\%$ predicted, 6-min walk test distance < 300 m, or inability to walk 1 block on level ground because of dyspnea or fatigue).
- Intolerance to RAASi because of hypotension or worsening renal function.
- Intolerance to beta blockers as a result of worsening HF or hypotension.
- Recent need to escalate diuretics to maintain volume status, often reaching daily furosemide equivalent dose > 160 mg/d or use of supplemental metolazone therapy.
- Refractory clinical congestion.
- Progressive deterioration in renal or hepatic function.

- Worsening right HF or secondary pulmonary hypertension.
- Frequent SBP ≤ 90 mm Hg.
- Cardiac cachexia.
- Persistent hyponatremia (serum sodium, <134 mEq/L).
- Refractory or recurrent ventricular arrhythmias; frequent ICD shocks.
- Increased predicted 1-year mortality (eg, $>20\%$) according to HF survival models (eg, MAGGIC,²¹ SHFM²²).

HF indicates heart failure; ICD, implantable cardioverter-defibrillator; MAGGIC, Meta-analysis Global Group in Chronic Heart Failure; NYHA, New York Heart Association; RAASi, renin-angiotensin-aldosterone system inhibitors; SBP, systolic blood pressure; SHFM, Seattle Heart Failure model; and VO₂, oxygen consumption/oxygen uptake.

ESC 2026 GL on HF. Criteria for definition of advanced heart failure

All the following criteria must be present despite FMT, AMT, and GDIT:

1. Severe and persistent symptoms of HF (NYHA class III or IV).
2. Severe cardiac dysfunction defined by at least one of the following:
 - LVEF $\leq 30\%$
 - Isolated RV failure (e.g. ARVC)
 - Non-operable severe valve abnormalities
 - Non-operable severe congenital abnormalities
 - Persistently high (or increasing) BNP or NT-proBNP values and severe LV diastolic dysfunction or structural abnormalities (i.e. HFpEF,^a hypertrophic or restrictive cardiomyopathies).
3. Episodes of pulmonary or systemic congestion requiring high-dose i.v. diuretics (or diuretic combinations) or malignant arrhythmias causing ≥ 2 unplanned visits or hospitalizations in the last 12 months, or ≥ 1 episode of low output requiring inotropes or vasoactive drugs.
4. Severe impairment of exercise capacity with inability to exercise, or low 6-min walk test distance (<300 m), or pVO₂ <12 – 14 mL/kg/min,^b or $<50\%$ predicted value, estimated to be of cardiac origin.

AMT, additional medical therapy; ARVC, arrhythmogenic right ventricular cardiomyopathy; BNP, B-type natriuretic peptide; FMT, foundational medical therapy; GDIT, guideline-directed interventional therapy; HF, heart failure; HFpEF, heart failure with preserved ejection fraction; i.v., intravenous; LV, left ventricular; LVEF, left ventricular ejection fraction; NT-proBNP, N-terminal pro-B-type natriuretic peptide; NYHA, New York Heart Association; pVO₂, peak oxygen consumption; RV, right ventricular.

^aSee Table 10.

^bThe cut-off 12 mL/kg/min refers to patients on beta-blocker.

ESC 2026 GL on HF. Recommendations for diagnosis and evaluation of advanced heart failure

Early consultation with an advanced HF centre ^c is recommended in patients with advanced HF or at risk of advanced HF, who are motivated and do not have absolute contraindications for heart transplantation or durable MCS ^d , in order to evaluate candidacy. ^{e 573,591}	I	A
Cardiopulmonary exercise testing is recommended in patients with advanced HF, as part of the evaluation for heart transplantation and durable MCS. ^{579,580,582}	I	C
Right heart catheterization is recommended in patients with advanced HF, as part of the evaluation for heart transplantation and durable MCS. ^{580–582}	I	C
Right heart catheterization is recommended in patients with advanced HF, as part of the evaluation for heart transplantation and durable MCS. ^{580–582}	I	C

HF, heart failure; LVAD, left ventricular assist device; MCS, mechanical circulatory support.

^dEligibility criteria are reported in [Tables 16](#) and [17](#).

^eThis recommendation is considered by the Task Force to have level of evidence A due to clear clinical effectiveness.

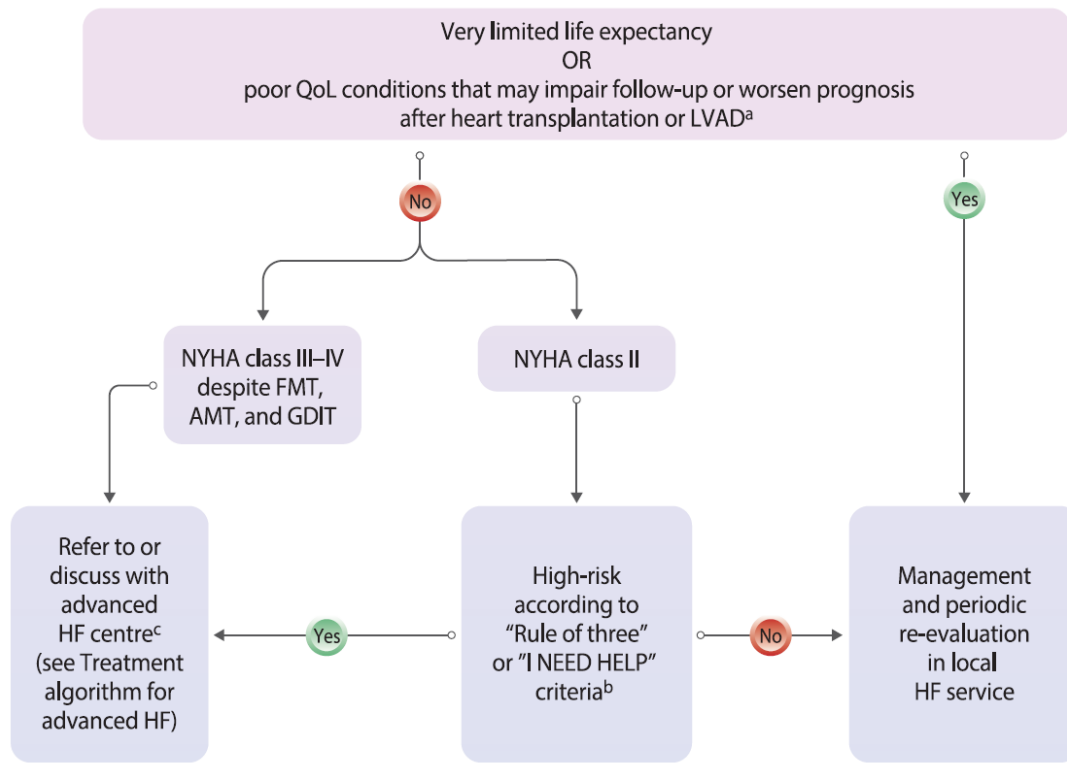


Figure 20. ESC 2026 GL on HF. Triage and timely referral of patients with advanced heart failure.

AMT, additional medical therapy; FMT, foundational medical therapy; GDIT, guideline-directed interventional therapy; HF, heart failure; LVAD, left ventricular assist device; NYHA, New York Heart Association; QoL, quality of life.

^aLimited life expectancy may be due to major comorbidities, such as cancer, dementia, end-stage irreversible organ dysfunction; other conditions that may impair follow-up or worsen post-treatment prognosis include frailty, irreversible cognitive dysfunction, psychiatric disorder, or psychosocial issues.

^bRefer to [Table 15](#) for ‘Rule of three’ or ‘I NEED HELP’ criteria.

^cA centre performing LVAD implantation and/or heart transplantation.

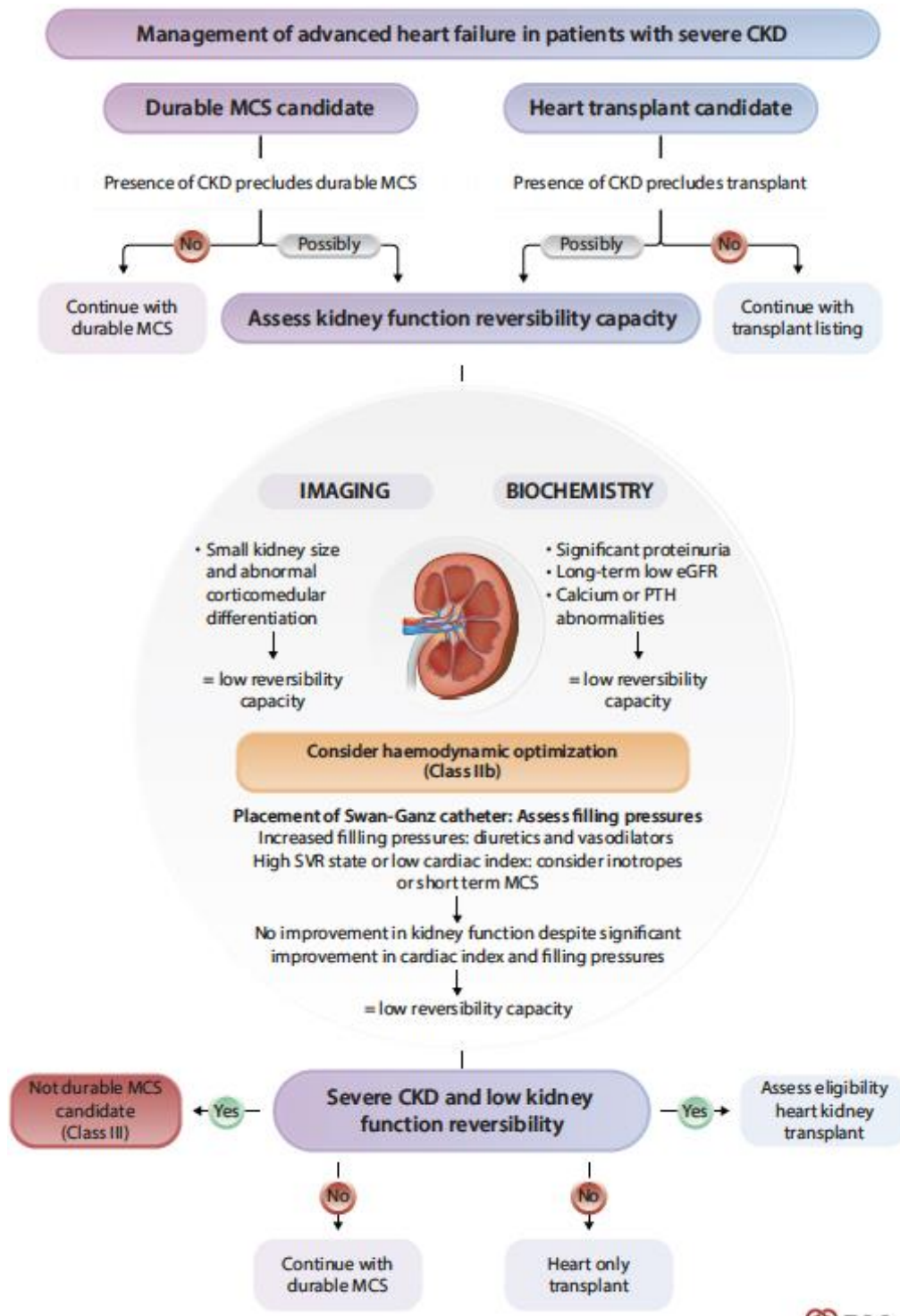


Figure 21. ESC 2026 GL on HF. Advanced heart failure and chronic kidney disease assessment.

CKD, chronic kidney disease; eGFR, estimated glomerular filtration rate; MCS, mechanical circulatory support; PTH, parathyroid hormone; SVR, systemic vascular resistance

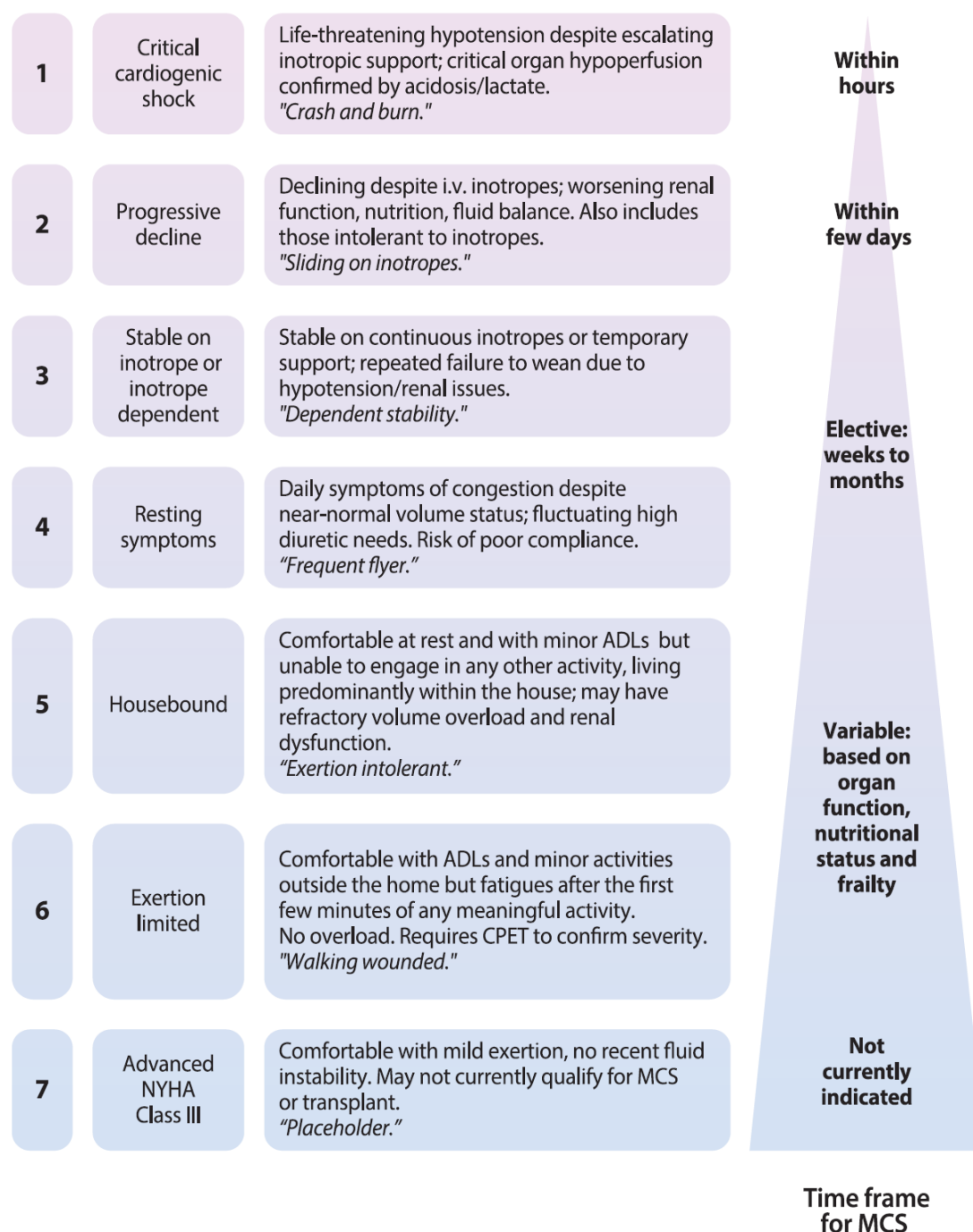


Figure 22. ESC 2026 GL on HF. INTERMACS classification.

ADLs, activities of daily living; CPET, cardiopulmonary exercise testing; HF, heart failure; i.v., intravenous; MCS, mechanical circulatory support; NYHA, New York Heart Association. The INTERMACS classification supports risk stratification and guides the timing of durable MCS or heart transplantation in patients with advanced HF.

Table 19. ACC/AHA/HFSA 2022 GL on HF. Management of Advanced Heart Failure

Specialty Referral for Advanced HF

In patients with advanced HF, when consistent with the patient’s goals of care, timely referral for HF specialty care to review HF management and assess suitability for advanced HF therapies (eg, LVAD, cardiac transplantation, palliative care, and palliative inotropes).

I C-LD

Nonpharmacological Management: Advanced HF

For patients with advanced HF and hyponatremia, the benefit of fluid restriction to reduce congestive symptoms is uncertain

IIb C-LD

Inotropic Support

In patients with advanced (stage D) HF refractory to GDMT and device therapy who are eligible for and awaiting MCS or cardiac transplantation, continuous intravenous inotropic support as “bridge therapy.”

IIa B-NR

In select patients with stage D HF, despite optimal GDMT and device therapy who are ineligible for either MCS or cardiac transplantation, continuous intravenous inotropic support as palliative therapy for symptom control and improvement in functional status.

IIb B-NR

In patients with HF, long-term use of either continuous or intermittent intravenous inotropic agents, for reasons other than palliative care or as a bridge to advanced therapies, is potentially harmful.

III B-R
Harm

Intravenous Inotropic Agents Used in the Management of HF

Inotropic Agent	Dose (mcg/kg)		Drug Kinetics and Metabolism	Effects				Adverse Effects	Special Considerations
	Bolus	Infusion (/min)		CO	HR	SVR	PVR		
Adrenergic agonists									
Dopamine	NA	5–10	t _{1/2} : 2–20 min	↑	↑	↔	↔	T, HA, N, tissue necrosis	Caution: MAO-I
	NA	10–15	R, H, P	↑	↑	↑	↔		
Dobutamine	NA	2.5–20	t _{1/2} : 2–3 min H	↑	↑	↔	↔	↑/↓BP, HA, T, N, F, hypersensitivity	Caution: MAO-I; CI: sulfite allergy
PDE 3 inhibitor									
Milrinone	NR	0.125–0.75	t _{1/2} : 2.5 h H	↑	↑	↓	↓	T, ↓BP	Accumulation may occur in setting of renal failure; monitor kidney function and LFTs
Vasopressors									
Epinephrine	NR	5–15 mcg/min	t _{1/2} : 2–3 min	↑	↑	↑ (↓)	↔	HA, T	Caution: MAO-I
		15–20 mcg/min	t _{1/2} : 2–3 min	↑	↑↑	↑↑	↔	HA, T	Caution: MAO-I
Norepinephrine	NR	0.5–30 mcg/min	t _{1/2} : 2.5 min	↔	↑	↑↑	↔	↓ HR, tissue necrosis	Caution: MAO-I

BP indicates blood pressure; CI, contraindication; CO, cardiac output; F, fever; H, hepatic; HA, headache; HF, heart failure; HR, heart rate; LFT, liver function test; MAO-I, monoamine oxidase inhibitor; N, nausea; NA, not applicable; NR, not recommended; P, plasma; PDE, phosphodiesterase; PVR, pulmonary vascular resistance; R, renal; SVR, systemic vascular resistance; T, tachyarrhythmias; and $t_{1/2}$, elimination half-life.

Up arrow means increase. Side arrow means no change. Down arrow means decrease. Up/down arrow means either increase or decrease.

Vasoactive Agents Used in CS

Category	Agent(s)	Mechanism of Action/Receptor Binding	Dosing	Hemodynamic Effects			
				SVR	BP	CO	HR
Inopressor	Norepinephrine	α 1 (+++), β 1 (+), β 2 (+)	0.05-1 μ g/kg/min	↑↑	↑↑	↑	↑
	Epinephrine	β 1 (+++), α 1 (+), β 2 (++)	0.01-0.5 μ g/kg/min	↑↑	↑↑	↑↑	↑↑
	Dopamine	D1 (+++), β 1 (+), α 1 (+)	Low: 2-5 μ g/kg/min Intermediate: 5-10 μ g/kg/min High: 10-20 μ g/kg/min	↑↑	↑↑	↑	↑↑
Inodilator	Dobutamine	β 1 (+++), β 2 (++)	2-10 μ g/kg/min	↓↔	↓↔	↑↑	↑
	Milrinone	PDE-3 inhibitor	0.125-0.5 μ g/kg/min	↓↓	↓↓	↑↑	↔↑
Vasopressor	Phenylephrine	α 1 (+++)	0.1-10 μ g/kg/min	↑	↑↑	↔↓	↔↓
	Vasopressin	Vasopressin receptor	0.01-0.04 U/min	↑↑	↑↑	↔↓	↔↓
Vasodilator	Nitroprusside	NO production	0.3-10 μ g/kg/min	↓	↓	↑↔	↑↔
	Nitroglycerin	Converts to NO	25-200 μ g/min	↓	↓	↑↔	↑↔
Chronotrope	Isoproterenol	β 1 (+++), β 2 (+++)	2-20 μ g/min	↓	↔	↑	↑↑
	Dopamine	See above					
Inotrope	Levosimendan*	Binds to troponin C, making it more sensitive to calcium thereby improving interaction between troponin C and I	0.05-0.2 μ g/kg/min	↓	↓	↑	↔

*Not FDA approved for clinical use in the United States.

↑ = increased effects; ↓ = decreased effects; ↔ = neutral effects; (+++) = strong binding; (++) = moderate binding; (+) = weak binding; α 1 = α -1 receptor; β 1 = β -1 receptor; β 2 = β -2 receptor; BP = blood pressure; CO = cardiac output; CS = cardiogenic shock; D1 = D1 receptor; FDA = U.S. Food and Drug Administration; HR = heart rate; NO = nitric oxide; PDE-3 = phosphodiesterase 3; SVR = systemic vascular resistance.

2025 Concise Clinical Guidance: An ACC Expert Consensus Statement on the Evaluation and Management of Cardiogenic Shock. *J Am Coll Cardiol*. 2025;85:1618-1641.

Table 20. ESC 2026 GL on HF. Recommendations for medical management of advanced heart failure

Down-titration or discontinuation of beta-blockers or ivabradine should be considered in selected patients with advanced HFrEF and evidence of organ hypoperfusion, despite initial treatment, to increase cardiac output and improve symptoms.	Ila	C
Continuous inotropes should be considered in patients with advanced HFrEF, low cardiac output, and evidence of hypoperfusion or end-organ dysfunction, as BTD, BTT or as bridge to durable MCS, to increase cardiac output and improve symptoms. ^{598,599}	Ila	C
Kidney replacement therapy should be considered in patients with refractory volume overload and end-stage kidney failure to improve symptoms. ⁶⁰⁰	Ila	C
Ultrafiltration may be considered in patients with refractory volume overload unresponsive to escalation of diuretic therapy to reduce the risk of rehospitalization. ⁶⁰¹	Ilb	C

BTD, bridge to decision; BTT, bridge to transplantation; HFrEF, heart failure with reduced ejection fraction; MCS, mechanical circulatory support.

Table 21. ESC 2026 GL on CKD. Management of patients with advanced heart failure and chronic kidney disease

Evaluation by a heart-kidney transplant team should be considered in all patients with advanced HF eligible for heart transplant and a baseline eGFR <30 mL/min/1.73 m ² to assess the need for dual organ transplant. ⁴²¹	IIa	C
A strategy of haemodynamic optimization (tailored approach of applying diuretics, inotropes, and short-term MCS based on invasive haemodynamics) may be considered in patients with CKD (not on long-term KRT) and advanced HF to assess eligibility for durable MCS or transplantation. ⁴²¹	IIb	C
Durable MCS is not recommended in patients with advanced HF with a baseline eGFR <30 mL/min/1.73 m ² (which is unlikely to improve) who are not potential candidates for dual organ transplantation, to reduce the risk of death in this population. ^{432,433}	III	C

CKD, chronic kidney disease; eGFR, estimated glomerular filtration rate; HF, heart failure; MCS, mechanical circulatory support; KRT, kidney replacement therapy.

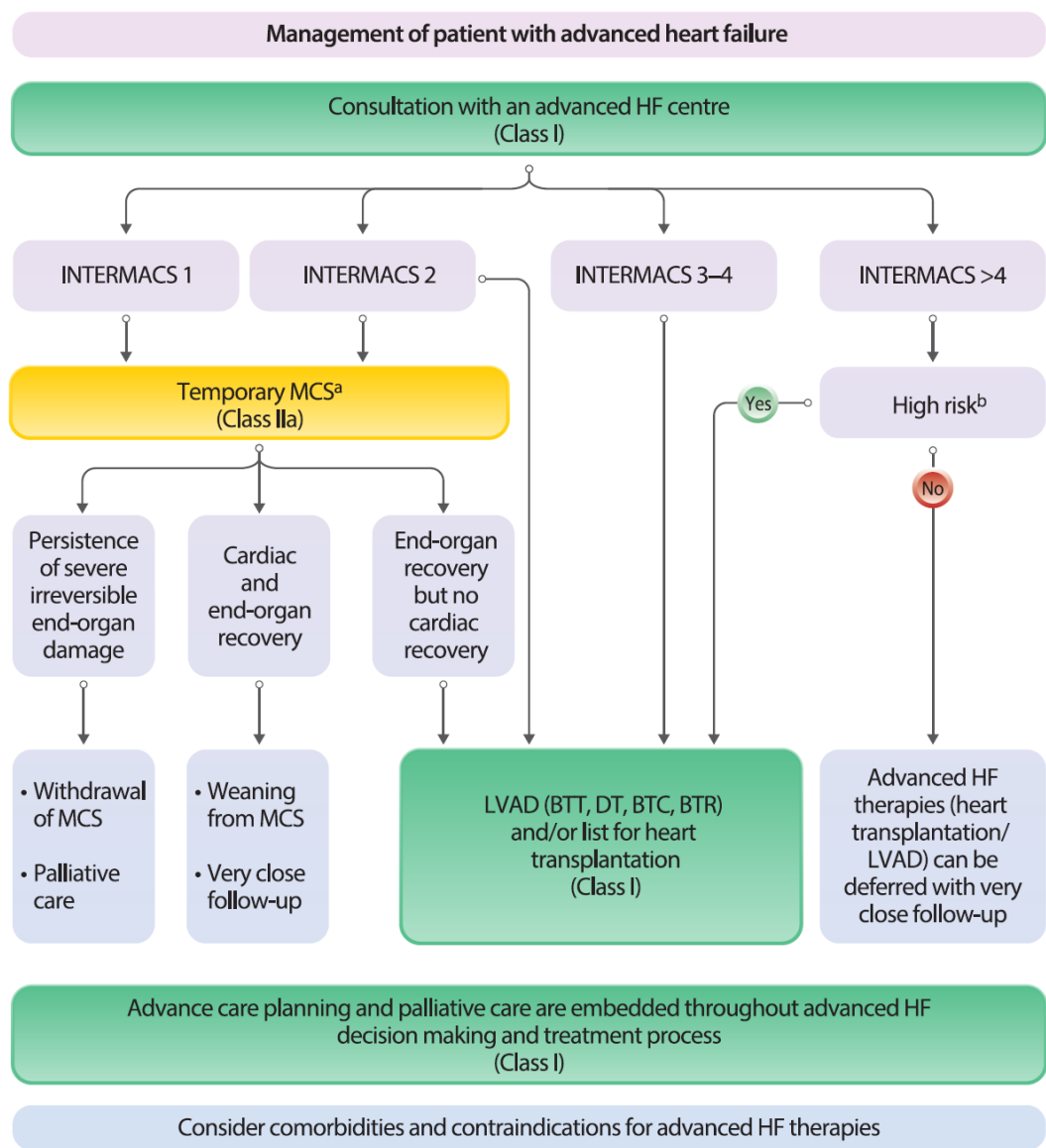


Figure 23. ESC 2026 GL on HF Treatment for advanced heart failure.

ARVC, arrhythmogenic right ventricular cardiomyopathy; BTC, bridge to candidacy; BTR, bridge to recovery; BTT, bridge to transplantation; CA, cardiac amyloidosis; CMP, cardiomyopathy; DT, destination therapy; ESC, European Society of Cardiology; HCM, hypertrophic cardiomyopathy; HF, heart failure; HFA, Heart Failure Association; INTERMACS, Interagency Registry for Mechanically Assisted Circulatory Support; LVAD, left ventricular assist device; MCS, mechanical circulatory support. The figure depicts a guidance for advanced HF treatment based on clinical profile. Colour code for classes of recommendation: green for Class of recommendation I and yellow for Class of recommendation IIa. This algorithm can be applied to all patients with advanced HF defined according to the ESC/HFA criteria, with exception of arrhythmic storm, and refractory angina. HCM, CA, other restrictive CMP, ARVC, and adult congenital heart disease are other exceptions. ^aTo be discussed with the Shock Team. ^bRecurrent hospitalization, progressive end-organ failure, refractory congestion, inability to perform cardiopulmonary exercise test or peak oxygen consumption <12–14 mL/kg/min or <50% of expected value

Table 22. ACC/AHA/HFSA 2022 GL on HF. Mechanical circulatory support

Indications and Contraindications to Durable Mechanical Support

Indications (combination of these):
Frequent hospitalizations for HF
NYHA class IIIb to IV functional limitations despite maximal therapy
Intolerance of neurohormonal antagonists
Increasing diuretic requirement
Symptomatic despite CRT
Inotrope dependence
Low peak VO_2 (<14–16)
End-organ dysfunction attributable to low cardiac output
Contraindications:
Absolute
Irreversible hepatic disease
Irreversible renal disease
Irreversible neurological disease
Medical nonadherence
Severe psychosocial limitations
Relative
Age >80 y for destination therapy
Obesity or malnutrition
Musculoskeletal disease that impairs rehabilitation
Active systemic infection or prolonged intubation
Untreated malignancy
Severe PVD
Active substance abuse
Impaired cognitive function
Unmanaged psychiatric disorder
Lack of social support

CRT indicates cardiac resynchronization therapy; HF, heart failure; NYHA, New York Heart Association; VO_2 , oxygen consumption; and PVD, peripheral vascular disease.

Mechanical Circulatory Support

In select patients with advanced HFrEF with NYHA class IV symptoms who are deemed to be dependent on continuous intravenous inotropes or temporary MCS, durable LVAD implantation to improve functional status, QOL, and survival. I A

In select patients with advanced HFrEF who have NYHA class IV symptoms despite GDMT, durable MCS to improve symptoms, improve functional class, and reduce mortality. IIa B-R

In patients with advanced HFrEF who have NYHA class IV symptoms despite GDMT, durable MCS devices provide low to intermediate economic value based on current costs and outcomes. Value Statement:
Uncertain Value (B-NR)

In patients with advanced HFrEF and hemodynamic compromise and shock, temporary MCS, including percutaneous and extracorporeal ventricular assist devices, as a “bridge to recovery” or “bridge to decision”. IIa B-NR

Table 23. ESC 2026 GL on HF. Indications and contraindications for implantation of a left ventricular assist device

Indications ^a
HF with severely reduced LVEF and one of the following:
• INTERMACS 1–2 with neurological and other end-organ recovery but no cardiac recovery on temporary MCS
OR
• INTERMACS 2–4
OR
• Severe symptoms and signs (NYHA class III/IV; INTERMACS >4) despite optimal FMT and GDIT, and at least one of the following: - o Unable to exercise due to HF or, if able to perform CPET, with $pVO_2 < 12\text{--}14\text{ mL/kg/min}$ and/or $< 50\%$ predicted value. - o End-organ dysfunction (worsening kidney and/or hepatic function, group 2 pulmonary hypertension, cardiac cachexia) due to reduced perfusion as indicated by cardiac index $\leq 2\text{ L/min/m}^2$ despite euvolaemic or therapy-resistant hypervolaemic status. - o Repeated HFH within the previous 12 months without an obvious precipitating cause.
Contraindications
Absolute:
• Severe right ventricular dysfunction despite euvolaemic status • Severe irreversible end-organ (kidney and/or liver) disease • Severe irreversible neurological disease • Severe pulmonary disease • Contraindication to long-term oral anticoagulation • Medical non-adherence and/or other psychosocial limitations • Insufficient social supports to achieve compliant care in the outpatient setting • Psychological instability that jeopardizes proper follow-up and intensive therapeutic regime after implantation
Relative:
• Obesity or malnutrition • Musculoskeletal disease that impairs rehabilitation • Malignancy (depending on type and prognosis) • Severe peripheral arterial disease • Systemic infection • Alcohol or substance abuse within the past 6 months, or active smoking • Impaired cognitive function • Frailty

CPET, cardiopulmonary exercise testing; HF, heart failure; HFH, heart failure hospitalization; INTERMACS, Interagency Registry for Mechanically Assisted Circulatory Support; LVEF, left ventricular ejection fraction; MCS, mechanical circulatory support; NYHA, New York Heart Association; pVO_2 , peak oxygen consumption; RHC, right heart catheterization.

^aIndication by transplantation centre includes assessment of HF severity by RHC and/or CPET.

Table 24. ESC 2026 GL on HF. Recommendations for durable mechanical circulatory support in advanced heart failure

Durable MCS (LVAD) is recommended in selected ^c patients with advanced HFrEF, despite FMT and GDIT, as BTT, BTC, BTR, or as destination therapy to improve symptoms and reduce the risk of death. ^{604,611,613,620,621}	I	C
Histopathological examination of explanted heart tissue from LVAD or heart transplantation surgery should be considered in patients with non-ischaemic HF to identify an aetiological diagnosis that may be treatable or facilitate family screening. ^{616,618}	IIa	C

BTC, bridge to candidacy; BTR, bridge to recovery; BTT, bridge to transplantation; FMT, foundational medical therapy; GDIT, guideline-directed interventional therapy; HF, heart failure; HFrEF, heart failure with reduced ejection fraction; LVAD, left ventricular assist device; MCS, mechanical circulatory support.

^aClass of recommendation.

Table 25. Cardiac Transplantation

ESC 2026 GL on HF. Indications and contraindications for heart transplantation

Indications ^a
Advanced HF and no other therapeutic option (except for durable MCS as BTT)
Absolute contraindications
Inability to comply with the therapeutic regimen (e.g. dementia)
Serious comorbidities with poor prognosis, not reversible with heart transplantation
Other contraindications
Active infection ^b
Severe peripheral arterial or cerebrovascular disease
Elevated pulmonary vascular resistance (if pharmacologically irreversible) ^c
Cancer ^d
Irreversible liver dysfunction (cirrhosis) or irreversible kidney dysfunction ^e
Systemic disease with multiorgan involvement
BMI >35 kg/m ² or severe cachexia
Alcohol or substance abuse or active smoking within the past 6 months
Psychological instability
Insufficient social support to achieve compliant care in the outpatient setting

BMI, body mass index; BTT, bridge to transplantation; CPET, cardiopulmonary exercise testing; HF, heart failure; LVAD, left ventricular assist device; MCS, mechanical circulatory support; RHC, right heart catheterization.

^aIndication by heart transplantation centre includes assessment of HF severity by RHC and/or CPET.

^bActive infection is a relative contraindication to transplantation, but infected LVAD may be an indication.

^cLVAD as bridge to candidacy should be considered.

^dHighly selected cases may be eligible, to be discussed with an oncologist.

^eCombined heart–liver or heart–kidney transplantation may be considered.

ESC 2026 GL on HF. Recommendations for heart transplantation

Heart transplantation is recommended in selected ^c patients with advanced HF refractory to FMT and GDIT, and without contraindications, to improve QoL and survival. ^{622,626}	I	C
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FMT, foundational medical therapy; GDIT, guideline-directed interventional therapy; HF, heart failure; QoL, quality of life.

^aClass of recommendation.

ACC/AHA/HFSA 2022 GL on HF. Cardiac Transplantation

For selected patients with advanced HF despite GDMT, cardiac transplantation is indicated to improve survival and QOL. I C-LD

In patients with stage D (advanced) HF despite GDMT, cardiac transplantation provides intermediate economic value. Value Statement: Intermediate Value (C-LD)

ESC 2022 GL on VA and SCD. Recommendations for the prevention of sudden cardiac death before and after heart transplantation

Prior to heart transplant

In patients awaiting heart transplantation, ICD implantation for primary prevention IIa C

WCD in patients awaiting heart transplantation IIb C

Post heart transplant

ICD in selected transplanted patients with cardiac allograft vasculopathy or treated rejection IIb C

ICD, implantable cardioverter defibrillator; WCD, wearable cardioverter defibrillator.

Table 26. Non-cardiac Surgery

ESC 2022 GL on non-cardiac surgery.

Recommendations for management of heart failure in patients undergoing non-cardiac surgery

In patients with suspected or known HF scheduled for high-risk NCS, evaluate LV function with echocardiography and measurement of NT-proBNP/BNP levels, unless this has recently been performed. I B

Patients with HF undergoing NCS to receive optimal medical treatment according to current ESC guidelines. I A

In patients with HF undergoing NCS, regularly assess volume status and signs of organ perfusion. I C

A multidisciplinary team including VAD specialists for peri-operative management of patients with HF receiving mechanical circulatory support. I C

BNP, B-type natriuretic peptide; ESC, European Society of Cardiology; HF, heart failure; LV, left ventricular; MCS, mechanical circulatory support; NCS, non-cardiac surgery; NT-proBNP, N-terminal pro-B-type natriuretic peptide; VAD, ventricular assist device.

Peri-operative approach to patients with ventricular assist devices undergoing non-cardiac surgery

Pre-operative	Intra-operative	Post-operative
• Multidisciplinary team identified (primary surgical and anaesthesia teams, cardiac surgery, HF cardiologist, VAD personnel) • Pre-operative medical optimization when possible or necessary • Physical examination focused on the sequelae of HF • Baseline ECG, echocardiogram, and laboratory values • Manage pacemaker/ICD settings when indicated • CT examination to evaluate possible driveline interference with the operative field • Hold, bridge, or reverse anticoagulation when indicated, after VAD team consultation	• Standard American Society of Anesthesiologists monitors • Cerebral tissue oxygenation, processed electroencephalogram, arterial line with ultrasound guidance, central venous catheter if fluid shifts are expected, PA catheter only if severe pulmonary hypertension, TEE available • Monitor VAD control console • External defibrillator pads in place • Optimize pre-load, support RV function, avoid increase in afterload • Gradual peritoneal insufflations and position changes	• Standard post-anaesthesia care unit unless ICU is otherwise indicated • Extubation criteria are unchanged • Avoid hypoventilation, optimize oxygenation • Resume heparin infusion when post-op bleeding risk is acceptable

CT, computed tomography; ECG, electrocardiogram; HF, heart failure; ICU, intensive care unit; PA, pulmonary artery; RV, right ventricular; TEE, transoesophageal echocardiography; VAD, ventricular assist device.

AHA/ACC 2024 Guideline on Noncardiac Surgery.

Recommendations for Heart Failure

1	C-LD	1. In patients with HF undergoing elective NCS, sodium-glucose cotransporter-2 inhibitors (SGLT2i) should be withheld for 3 to 4 days* before surgery when feasible to reduce the risk of perioperative metabolic acidosis. ¹⁻³
2a	C-LD	2. In patients with compensated HF undergoing NCS, it is reasonable to continue GDMT (excluding SGLT2i) in the perioperative period, unless contraindicated, to reduce the risk of worsening HF. ⁴⁻⁸

*Canagliflozin, dapagliflozin, and empagliflozin should be stopped ≥3 days and ertugliflozin ≥4 days before scheduled surgery.³

Recommendation for Left Ventricular Assist Devices

1	C-EO	1. In patients with a left ventricular assist device (LVAD), coordination with the LVAD care team on the appropriate timing and perioperative considerations of elective NCS is recommended to mitigate the risk of perioperative MACE.
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Association of Heart Failure and Left Ventricular Ejection Fraction With 90-day Mortality Rate in Patients Undergoing Noncardiac Surgery

Management Considerations

Continue beta blockers and/or nondihydropyridine calcium channel blockers without interruption in the perioperative period

Avoid hypovolemia and reduced preload (can worsen LVOT obstruction)

Avoid hypotension and reduced afterload (can worsen LVOT obstruction)

Avoid tachycardia to ensure adequate LV filling

If hypotension develops:

- Prioritize intravenous fluid administration to correct hypovolemia
- Use alpha-agonists, such as phenylephrine or vasopressin,⁷ rather than beta-agonists, which can worsen LVOT obstruction
- Consider intraoperative echocardiography to evaluate LVOT obstruction in the setting of hypotension
- In selected cases, intravenous beta-blockade may be necessary to reduce LV myocardial contractility and relieve LVOT obstruction

LV indicates left ventricular; and LVOT, left ventricular outflow tract.

Table 27. ESC 2026 GL on HF. Recommendations for exercise training and cardiac rehabilitation

Personalized exercise training, in the context of multidisciplinary exercise-based cardiac rehabilitation, is recommended for all stable patients, unless there are specific contraindications, in order to improve exercise capacity and QoL, and reduce the risk of all-cause hospitalization. ¹⁰²¹	I	B1
Personalized exercise training outside exercise-based cardiac rehabilitation is recommended for all stable patients on a long-term basis, unless there are specific contraindications, in order to improve exercise capacity and QoL, and reduce the risk of all-cause hospitalization. ¹⁰²²	I	B2
Cardiac rehabilitation ^c is recommended in patients with an LVAD to improve functional capacity and QoL. ^{1005,1023}	I	B1
Cardiac rehabilitation ^c should be considered in patients with DHF, as soon as safely possible, to improve functional capacity and QoL. ^{1002,1024–1026}	IIa	B1

DHF, decompensated heart failure; LVAD, left ventricular assist device; QoL, quality of life.

cEither comprehensive or exercise-based.

Table 28. ESC 2020 GL on Sports. Heart Failure

Optimal exercise training dose for patients with chronic heart failure

	Aerobic exercise	Resistance exercise
Frequency	3–5 days/week, optimally daily	2–3 days/week; balance training daily
Intensity	40–80% of $\text{VO}_{2\text{peak}}$	Borg RPE <15 (40–60% of 1RM)
Duration	20–60 min	10–15 repetitions in at least 1 set of 8–10 different upper and lower body exercises
Mode	Continuous or interval	
Progression	A progressively increasing training regimen should be prescribed with regular follow-up controls (at least every 3–6 months) to adjust the duration and the level of the exercise to the reached level of tolerance	A progressively increasing training regimen should be prescribed with regular follow-up controls (at least every 3–6 months) to adjust the duration and the level of the exercise to the reached level of tolerance

1 RM = one repetition maximum; RPE = rating of perceived exertion; $\text{VO}_{2\text{peak}}$ = peak oxygen consumption.

Recommendations for participation in sports in heart failure

Before considering a sport activity, a preliminary optimization of heart failure risk factor control and therapy, including device implantation (if appropriate)	I C
Participation in sports activities of individuals with heart failure who are at low risk risk, based on a complete assessment and exclusion of all contraindications, in stable condition for at least 4 weeks, optimal treatment, and NYHA functional class I status.	IIa C
Non-competitive (low- to moderate-intensity recreational) skill, power, mixed, or endurance sports in stable, asymptomatic, and optimally treated individuals with HFmrEF.	IIb C
High-intensity recreational sports, adapted to the capabilities of the individual patient of the individual patient, in selected stable, asymptomatic, and optimally treated individuals with HFmrEF with an age-matched exercise capacity beyond average.	IIb C
Non-competitive (low-intensity recreational skill-related sports) (when tolerated) in stable, optimally treated individuals with HFrEF.	IIb C
High-intensity power and endurance sports are not recommended in patients with HFrEF irrespective of symptoms.	III C

HFmrEF = heart failure with mid-range ejection fraction; HFrEF = heart failure with reduced ejection fraction; NYHA = New York Heart Association.

Recommendations for exercise prescription in heart failure with reduced or mid-range ejection fraction

Regular discussion about exercise participation and provision of an individualized exercise prescription	I A
Exercise-based cardiac rehabilitation in all stable individuals to improve exercise capacity, quality of life, and to reduce the frequency of hospital readmission.	I A
Beyond annual cardiac assessment, clinical reassessment when the intensity of exercise is increased.	IIa C
Motivational and psychological support and individualized recommendations on how to progress the amount and intensity of sports activities. should be considered.	IIa C
Low- to moderate-intensity recreational sporting activities and participation in structured exercise programmes in stable individuals.	IIb C
High-intensity interval training programmes in low-risk patients who want to return to high-intensity aerobic and mixed endurance sports.	IIb C

Table 29. ESC 2020 GL on Sports. Recommendations for exercise and participation in sport in individuals with heart failure with preserved ejection fraction

Moderate endurance and dynamic resistance exercise, together with lifestyle intervention and optimal treatment of cardiovascular risk factors (i.e. arterial hypertension and type 2 diabetes)	I C
Competitive sports in selected stable patients without abnormalities on maximal exercise testing.	IIa C

Table 30. ESC 2020 GL on Sports. Recommendations for exercise and participation in sport in heart transplant recipients

Regular exercise through cardiac rehabilitation, combining moderate-intensity aerobic and resistance exercise, to revert pathophysiology to pre-transplantation time, reduce cardiovascular risk induced by post-transplantation medical treatment, and improve clinical outcome.	I B
Recreational (low-intensity recreational) sports participation in stable, asymptomatic individuals after therapy optimization.	IIa C
Eligibility for competitive sports involving low and moderate-intensity exercise in selected, asymptomatic individuals with an uncomplicated follow-up.	IIb C

Table 31. ESC 2021 GL on HF. Recommendations for invasive and non-invasive telemonitoring

Remote haemodynamic monitoring of PA pressure should be considered in symptomatic patients with HF, NYHA class III, and an HFH in the past 12 months in order to reduce the risk of HFH. ^{1029,1043,1045}	IIa	B1
Non-invasive telemonitoring modalities may be considered for patients with HF in order to reduce the risk of HFH. ^{1027,1029,1053}	IIb	B1

HF, heart failure; HFH, heart failure hospitalization; NYHA, New York Heart Association; PA, pulmonary artery.

Table 32. ESC 2026 GL on HF. Recommendations for the multidisciplinary management of heart failure

A multidisciplinary HF management programme is recommended in patients with HF to reduce the risk of HFH and death. ⁹⁶⁴⁻⁹⁶⁷	I	B1
HF education and self-management strategies in patients with HF are recommended to reduce the risk of HFH or death. ⁹⁷⁷	I	A
Multidisciplinary interventions to improve adherence, including assessment of health literacy and polypharmacy review, are recommended in patients with HF to reduce the risk of hospitalization and death. ⁹⁷⁸⁻⁹⁸¹	I	B2

HF, heart failure; HFH, heart failure hospitalization.

Table 33. ESC 2026 GL on HF. Recommendations for long term follow-up

Proactive discussion regarding HF trajectory, goals of care, and advance care planning is recommended in patients with advanced HF to facilitate communication on end of life and QoL. ⁶²⁷	I	B1
Access to an integrated HF palliative care multidisciplinary team is recommended for patients in an advanced HF stage to improve QoL and reduce symptom burden. ^{1066–1068}	I	B2

HF, heart failure; QoL, quality of life.

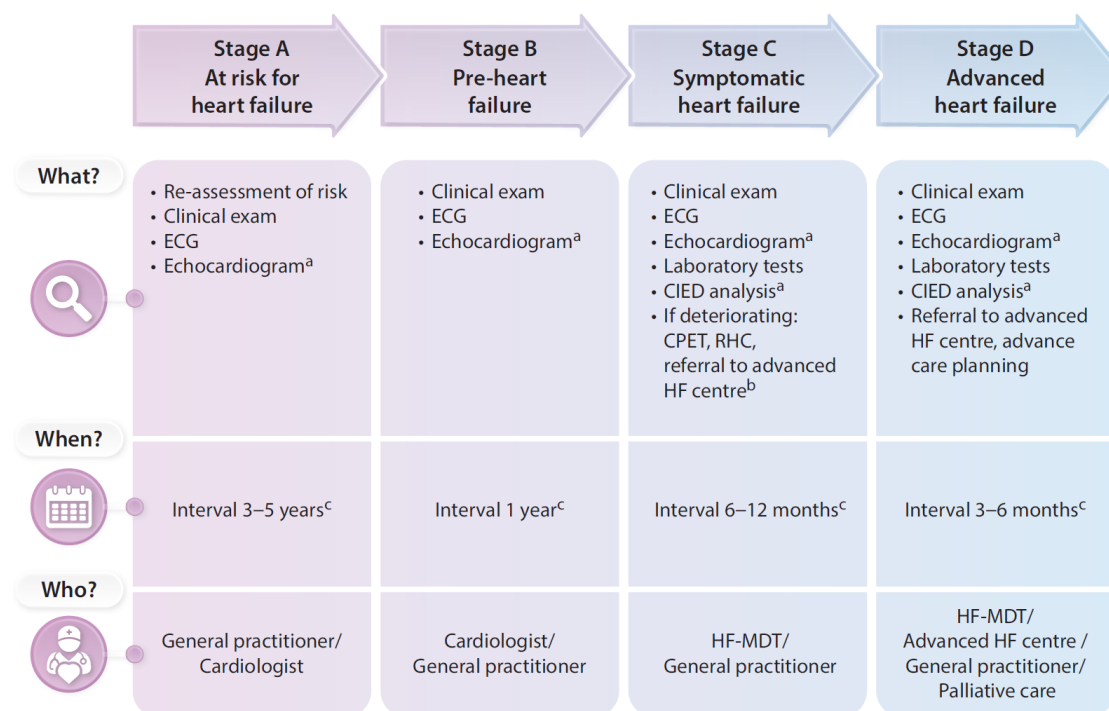


Figure 24. ESC 2026 GL on HF. Long-term follow-up of patients with stable heart failure—what—when—who.

CIED, cardiac implantable electronic device; CPET, cardiopulmonary exercise testing; ECG, electrocardiogram; HF, heart failure; HF-MDT, heart failure multidisciplinary team; RHC, right heart catheterization. ^aIf deemed clinically relevant. ^bCheck ‘I NEED HELP’ criteria ^cIntervals may be shorter.

Table 34. ACC/AHA/HFSA 2022 GL on HF. Integration of Care

Transitions and Team-Based Approaches

In patients with high-risk HF, particularly those with recurrent hospitalizations for HFrEF, referral to multidisciplinary HF disease management programs to reduce the risk of hospitalization.	I B-R
In patients hospitalized with worsening HF, patient-centered discharge instructions with a clear plan for transitional care should be provided before hospital discharge.	I B-NR
In patients hospitalized with worsening HF, participation in systems that allow benchmarking to performance measures, increase use of evidence-based therapy, and improve quality of care.	IIa B-NR
In patients being discharged after hospitalization for worsening HF, an early follow-up, generally within 7 days of hospital discharge, to optimize care and reduce rehospitalization.	IIa B-NR

Important Components of a Transitional Care Plan

A transitional care plan, communicated with the patient and their outpatient clinicians before hospital discharge, should clearly outline plans for:
Addressing any precipitating causes of worsening HF identified in the hospital;
Adjusting diuretics based on volume status (including weight) and electrolytes;
Coordination of safety laboratory checks (eg, electrolytes after initiation or intensification of GDMT);
Further changes to optimize GDMT, including: Plans for resuming medications held in the hospital; Plans for initiating new medications; Plans for titration of GDMT to goal doses as tolerated;
Reinforcing HF education and assessing compliance with medical therapy and lifestyle modifications, including dietary restrictions and physical activity;
Addressing high-risk characteristics that may be associated with poor post-discharge clinical outcomes, such as: Comorbid conditions (eg, renal dysfunction, pulmonary disease, diabetes, mental health, and substance use disorders); Limitations in psychosocial support; Impaired health literacy, cognitive impairment;
Additional surgical or device therapy, referral to cardiac rehabilitation in the future, where appropriate;
Referral to palliative care specialists and/or enrollment in hospice in selected patients.

GDMT indicates guideline-directed medical therapy; and HF, heart failure.

Table 35. ACC/AHA/HFSA 2022 GL on HF. Quality Metrics and Reporting.

Performance Measurement

Performance measures based on professionally developed clinical practice guidelines should be used with the goal of improving quality of care for patients with HF. I B-NR

Participation in quality improvement programs, including patient registries that provide benchmark feedback on nationally endorsed, clinical practice guideline–based quality and performance measures can be beneficial in improving the quality of care for patients with HF IIa B-NR

Patient-Reported Outcomes

In patients with HF, standardized assessment of patient-reported health status using a validated questionnaire can be useful to provide incremental information for patient functional status, symptom burden, and prognosis. IIa C-LD

Table 36. ACC/AHA/HFSA 2022 GL on HF. Palliative and Supportive Care, Shared Decision-Making, and End-of-Life

For all patients with HF, palliative and supportive care—including high-quality communication, conveyance of prognosis, clarifying goals of care, shared decision-making, symptom management, and caregiver support—should be provided to improve QOL and relieve suffering.¹ I C-LD

For patients with HF being considered for, or treated with, life-extending therapies, the option for discontinuation should be anticipated and discussed through the continuum of care, including at the time of initiation, and reassessed with changing medical conditions and shifting goals of care. I C-LD

For patients with HF—particularly stage D HF patients being evaluated for advanced therapies, patients requiring inotropic support or temporary mechanical support, patients experiencing uncontrolled symptoms, major medical decisions, or multimorbidity, frailty, and cognitive impairment—specialist palliative care consultation can be useful to improve QOL and relieve suffering. IIa B-R

For patients with HF, execution of advance care directives can be useful to improve documentation of treatment preferences, delivery of patient-centered care, and dying in preferred place. IIa C-LD

In patients with advanced HF with expected survival <6 months, timely referral to hospice can be useful to improve QOL. IIa C-LD

Table 37. ACC/AHA/HFSA 2022 GL on HF. Disparities and Vulnerable Populations

In vulnerable patient populations at risk for health disparities, HF risk assessments and multidisciplinary management strategies should target both known risks for CVD and social determinants of health, as a means toward elimination of disparate HF outcomes. I C-LD

Evidence of health disparities should be monitored and addressed at the clinical practice and the health care system levels I C-LD

Table 38. ACC/AHA/HFSA 2022 GL on HF. Risk of HF and Outcomes in Special Populations

Vulnerable Population	Risk of HF	HF Outcomes
Women	The lifetime risk of HF is equivalent between sexes, but HFpEF risk is higher in women—in FHS participants with new-onset HF, odds of HFpEF (EF >45%) are 2.8-fold higher in women than in men. ⁶⁶ Sex-specific differences in the predictive value of cardiac biomarkers for incident HF. ⁶⁷ Nontraditional cardiovascular risk factors, including anxiety, depression, caregiver stress, and low household income may contribute more toward incident heart disease in women than men. ⁶⁸	Overall, more favorable survival with HF than men. In the OPTIMIZE-HF registry, women with acute HF had a lower 1-y mortality (HR, 0.93; 95% CI, 0.89–0.97), although women are more likely not to receive optimal GDMT. ^{20,69–71} Lower patient-reported quality of life for women with HFpEF, compared with men. ^{10,71} Greater transplant waitlist mortality for women but equivalent survival after heart transplantation or LVAD implantation. ^{24,52}
Older adults	Per FHS, at 40 y of age, the lifetime risk of incident HF is 20% for both sexes; at 80 y of age, the risk remains 20% for men and women despite the shorter life expectancy. ⁷² LVEF is preserved in at least two-thirds of older adults with the diagnosis of HF. ⁷³	Among 1233 patients with HF aged ≥80 y, 40% mortality during mean 27-mo follow-up; survival associated with prescription of GDMT. ⁷⁴
Lower socioeconomic status populations	Among 27 078 White and Black adults of low income (70% earned <\$15 000/y) participating from 2002–2009 in the Southern Community Cohort Study, a 1 interquartile increase in neighborhood deprivation index was associated with a 12% increase in risk of HF (adjusted HR, 1.12; 95% CI, 1.07–1.18). ⁴⁶	Age-adjusted 1990–2018 HF mortality (deaths/100 000; mean and 95% CI) was higher with increasing quartiles of ADI, which is based on 17 indicators of employment, poverty, and education: Quartile 1, 20.0 (19.4–20.5); Quartile 2, 23.3 (22.6–24.0); Quartile 3, 26.4 (25.5–27.3); Quartile 4, 33.1 (31.8–34.4). ⁶
Black populations	In MESA, patients of Black race had highest risk of incident HF (4.6/1000 person-years) and highest proportion of nonischemic incident HF. ²⁶ Higher prevalence of HF risk factors including hypertension, obesity, and diabetes, compared with White populations. ⁷⁵	CDC data show race-based differences in HF mortality over time: Black men had a 1.16-fold versus 1.43-fold higher age-adjusted HF-related CVD death rate compared with White men in 1999 versus 2017; Black women had a 1.35-fold versus 1.54-fold higher age-adjusted HF-related CVD death rate compared with White women in 1999 versus 2017. ⁷⁷ Gap in outcomes is more pronounced among younger adults (35–64 y of age) versus older adults (65–84 y of age); age-adjusted HF-related CVD death rates were 2.60-fold and 2.97-fold higher in young Black versus White men and women, respectively. ⁷⁷ Higher rates of hospitalization ³ and mortality among patients with HFpEF. ⁷⁶ Lower 5-year survival after heart transplant. ^{77–79}
Hispanic populations	MESA study showed higher HF incidence in Hispanic compared with non-Hispanic White groups (3.5 versus 2.4 per 1000 person-years) but lower than for African Americans (4.6/1000 person-years). ^{72,80}	Despite higher rates of hospitalization for HF compared with non-Hispanic Whites, Hispanic patients with HF have shown lower short-term mortality rates. ⁸¹ In GWTG, Hispanic patients with HFpEF had lower mortality (OR, 0.50; 95% CI, 0.31–0.81) than non-Hispanic Whites, but this was not the case for Hispanic patients with HFREF (OR, 0.94; 95% CI, 0.62–1.43). ⁸² Lower risk of developing AF in the setting of HF, compared with White patients. ⁸³
Asian and Pacific Islander populations	Limited population-specific data for Asian and Pacific Islander subgroups in the United States. ^{84,85}	High rates of preventable HF hospitalization observed in some Asian and Pacific Islander populations. ¹³ Lower mortality rates from HF for Asian subgroups when listed as the primary cause of death, compared with non-Hispanic White groups. ⁸⁶
Native American and Alaskan Native populations	Limited population-specific data, with cardiovascular risk factor trends best characterized by the Strong Heart Study and Strong Heart Family Study, demonstrating high rates of hypertension and diabetes. ^{11,87}	Limited data suggest HF mortality rates in American Indians and Alaska Natives are similar to those in White populations. ⁸⁸

CDC indicates Centers for Disease Control and Prevention; CVD, cardiovascular disease; FHS, Framingham Heart Study; GDMT, guideline-directed medical therapy; GWTG, Get With The Guidelines registry; HF, heart failure; HFpEF, heart failure with preserved ejection fraction; HFREF, heart failure with reduced ejection fraction; HR, hazard ratio; LVAD, left ventricular assist device; LVEF, left ventricular ejection fraction; MESA, Multi-Ethnic Study of Atherosclerosis; OPTIMIZE-HF, Organized Program To Initiate Lifesaving Treatment In Hospitalized Patients With Heart Failure; and OR, odds ratio.

Table 39. ESC 2025 GL on Pregnancy. Recommendations for chronic and acute heart failure and pregnancy

Chronic heart failure	Class^a	Level^b
It is recommended that women with HFrEF are advised about the risk of deterioration of cardiac function during pregnancy and peripartum. ³⁴	I	C
In pregnant women with HFrEF, it is recommended that non-selective beta-blockers are switched to beta-1-selective blockers (metoprolol, bisoprolol) with close maternal and foetal monitoring. ^{733,734,738,739}	I	C
Anticoagulation with therapeutic doses of LMWH is recommended in pregnant women with intracardiac thrombus or decreased LV function with EF <35%. ²¹⁶	I	C
It is recommended to optimize HF guideline-directed medical therapy after delivery, taking contraindicated drugs during lactation into account. ^{339,734}	I	C
Due to the high metabolic demands of lactation, avoiding lactation may be considered in women with severe HF. ^{360,733}	IIb	C
ACE-Is, ARBs, ARNIs, MRAs, ivabradine, and SGLT2 inhibitors are not recommended during pregnancy due to adverse foetal effects.	III	C

ACE-I, angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blocker; ARNI, angiotensin receptor/neprilysin inhibitor; EF, ejection fraction; HF, heart failure; HFrEF, heart failure with reduced ejection fraction; LMWH, low-molecular-weight heparin; LV, left ventricle; MRA, mineralocorticoid receptor antagonist; SGLT2, sodium–glucose co-transporter-2.

Table 40. ESC 2026 GL on HF. Recommendations for heart failure and pregnancy

Pre-conception care and counselling is recommended for patients with HF to facilitate decision-making surrounding HF treatments, pregnancy, contraception, pre-implantation genetic screening, and assisted reproductive therapies.	I	C
In pregnant women with HFrEF, it is recommended that non-selective beta-blockers are switched to beta ₁ -selective blockers (metoprolol, bisoprolol) with close mother and foetus monitoring to reduce the risk of adverse foetal events and a lower birth weight. ^{1072,1073}	I	C
ACE-Is, ARBs, ARNIs, MRAs, ivabradine, and SGLT2-Is are not recommended during pregnancy due to the risk of foetotoxicity or teratogenicity. ¹⁰⁷⁴⁻¹⁰⁷⁶	III	C

ACE-I, angiotensin-converting enzyme inhibitor; ARB, angiotensin II receptor blocker; ARNI, angiotensin receptor-neprilysin inhibitor; HF, heart failure; HFrEF, heart failure with reduced ejection fraction; MRA, mineralocorticoid receptor antagonist; SGLT2-I, sodium-glucose co-transporter 2 inhibitor.

Table 41. ACC/AHA/HFSA 2022 GL on HF. HF and Pregnancy

In women with a history of HF or cardiomyopathy, including previous peripartum cardiomyopathy, provide patient-centered counseling regarding contraception and the risks of cardiovascular deterioration during pregnancy.	I C-LD
In women with acute HF caused by peripartum cardiomyopathy and LVEF <30%, anticoagulation at diagnosis, until 6 to 8 weeks postpartum, although the efficacy and safety are uncertain.	IIb C-LD
In women with HF or cardiomyopathy who are pregnant or currently planning for pregnancy, ACEi, ARB, ARNi, MRA, SGLT2i, ivabradine, and vericiguat should not be administered because of significant risks of fetal harm.	III C-LD

Table 42. ACC/AHA/HFSA 2022 GL on HF. HF Management Strategies Across the Pregnancy Continuum

	Preconception	During Pregnancy	Postpartum
Nonpharmacological strategies	Preconception genetic counseling and testing for potentially heritable cardiac conditions. Use of pregnancy cardiovascular risk tools,^{51,56–58} and echocardiography for myocardial structure and function assessment, to provide information that facilitates informed counseling. For women planning a pregnancy, provide personalized counseling that promotes the autonomy and goals of the patient (and her partner, as applicable), the patient's ability for self-care and risk awareness, and ensures adequate psychosocial support for decision-making.⁵ For women not currently planning a pregnancy but who might conceive, discuss HF-specific considerations regarding pregnancy and refer to gynecology or primary care for contraceptive counseling.	Close maternal monitoring for HF signs or symptoms or other cardiovascular instability by cardiology and obstetric and maternal-fetal medicine teams; close fetal monitoring by the obstetric and maternal-fetal medicine teams. Consideration of routine echocardiographic screening in the third trimester for reassessment of myocardial structure and function before labor; echocardiography for any significant changes in HF symptoms or signs during pregnancy, or if HF medications are reduced or discontinued.¹⁸ BNP or NT-proBNP monitoring during pregnancy may have some value for prediction of cardiovascular events.^{73,74} Close maternal monitoring by obstetrics and maternal-fetal medicine teams for preeclampsia, which has shared risk factors and pathogenesis with PPCM.^{40,75} For women presenting with decompensated HF or cardiogenic shock, hemodynamic monitoring and MCS, as appropriate, within a multidisciplinary collaborative approach that supports prompt decision-making about the timing and mechanism of delivery.	Multidisciplinary recommendations from obstetrics and neonatology and pediatrics teams and shared decision-making regarding the maternal and neonatal risks and benefits of breastfeeding. For women presenting with decompensated HF or cardiogenic shock, HF management should include hemodynamic monitoring and mechanical circulatory support as appropriate
Pharmacological strategies	Review of all current medications. For women planning pregnancy imminently, modification of HF pharmacotherapy including discontinuation of any ACEi, ARB, ARNI, MRA, or SGLT2i or ivabradine medications; within a construct of multidisciplinary shared decision-making, continuation of a beta blocker (most commonly metoprolol), hydralazine, and nitrates; adjustment of diuretic dosing to minimize the risk of placental hypoperfusion.^{15–19} Ideally, repeat echocardiography approximately 3 mo after preconception HF medication adjustments to ensure stability of myocardial structure and function before conception.	Close monitoring of maternal blood pressure, heart rate, and volume status, with adjustment of the modified HF regimen as appropriate to avoid hypotension (systemic vasodilation peaks in the second trimester) and placental hypoperfusion. For women with HF or cardiomyopathy presenting during pregnancy without preconception counseling and assessment, urgent discontinuation of any GDMT pharmacotherapies with fetal toxicities; within a construct of multidisciplinary shared decision-making, continuation of a beta blocker (most commonly metoprolol succinate), hydralazine, and nitrates; adjustment of diuretic dosing to minimize the risk of placental hypoperfusion.	For women with acute HF caused by PPCM and LVEF <30%, consideration of anticoagulation until 6–8 wk postpartum, although the efficacy and safety remain uncertain at this time. For postpartum women with severe acute HF caused by PPCM and LVEF <35%, in GDMT pharmacotherapy and prophylactic anticoagulation, to improve LVEF recovery.^{3,31,264,176;} the efficacy and safety of bromocriptine for acute PPCM treatment remains uncertain at this time, particularly in the setting of contemporary HF GDMT and cardiogenic shock management.* For women who choose to breastfeed, review medications with neonatology and pediatrics teams for neonatal safety during lactation, ideally with pharmacist consultation if available. Within a construct of multidisciplinary shared decision-making, medications that may be appropriate during breastfeeding include ACEi (enalapril or captopril preferred, monitor neonatal weight), beta blockers (metoprolol preferred, monitor neonatal heart rate).¹⁸ Diuretics can suppress lactation, but with neonatal follow-up the use of furosemide may be appropriate.¹⁹
Multidisciplinary care beyond the cardiology team	Consultation with genetics, gynecology, and maternal-fetal medicine teams, as appropriate to the outcome of shared decision-making.	Multidisciplinary management with obstetrics and maternal-fetal medicine teams during pregnancy. For women with decompensated HF or evidence of hemodynamic instability antepartum, delivery planning will include obstetrics and maternal-fetal medicine, anesthesia, and neonatology teams.	Multidisciplinary management with obstetrics, maternal-fetal medicine, neonatology, and pediatrics teams, especially for multidisciplinary recommendations regarding lactation. Consultation with gynecology team for ongoing contraceptive planning.

ACEi indicates angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blocker; ARNI, angiotensin receptor-neprilysin inhibitor; BNP, B-natriuretic peptide; GDMT, guideline-directed medical therapy; HF, heart failure; LVEF, left ventricular ejection fraction; MCS, mechanical circulatory support; MRA, mineralocorticoid receptor antagonist; NT-proBNP, N-terminal pro-hormone of brain natriuretic peptide; PPCM, peripartum cardiomyopathy; RCT, randomized controlled trial; RV, right ventricular; and SGLT2i, sodium-glucose cotransporter-2 inhibitor.

*An initial open-label pilot RCT in South Africa suggested addition of bromocriptine to GDMT was associated with greater LVEF improvement and a lower rate of the composite endpoint at 6 mo.³⁷ Among 96 women with acute PPCM in a Burkina Faso RCT, 4 wk of bromocriptine was associated with LVEF recovery and lower mortality (16.6% versus 29.1%; $P < 0.001$).³⁹ A multicenter German study randomized 63 patients to 1 versus 8 wk of bromocriptine (no placebo, as deemed unethical),³⁸ with LVEF recovery $\geq 50\%$ in 52% and 68% of the 1- and 8-wk groups, respectively, and no deaths. A substudy also showed high rates of RV recovery.⁴¹ Two retrospective cohorts (Germany, Canada) and a multicenter cohort of subsequent pregnancies also suggested greater LVEF recovery with bromocriptine. Bromocriptine may currently be most justified in women with LVEF <25% or cardiogenic shock. The downsides of prohibiting breastfeeding should be considered. Bromocriptine should be accompanied by at least prophylactic-dosed anticoagulation, because of potential hypercoagulability.

The European Society of Cardiology endorses “BOARD” (Bromocriptine, Oral HF therapy, Anticoagulation, vasoRelaxing agents, Diuretics) for acute PPCM management.

Table 43. EC 2025 GL on Pregnancy. Recommendations for heart transplantation and pregnancy

It is recommended to postpone pregnancy until at least 1 year after heart transplantation, taking individual risk factors into account. ^{275,741}	I	C
In women with a heart transplant, it is recommended that immunosuppression serum drug levels are monitored during pregnancy every 4 weeks until the 32nd week, then every 2 weeks until the 36th week, then weekly until delivery, and for 6–12 months after delivery to guide dosing. ²⁷⁵	I	C
It is recommended to perform weekly monitoring of donor-specific antibodies for at least 6–12 months after delivery. ^{275,741,749–751}	I	C
Paternal HLA testing prior to conception should be considered due to the risk of developing donor-specific antibodies. ^{746,747}	IIa	C
Mycophenolic acid therapy is not recommended in pregnancy and should be discontinued 6 weeks before conception. ^{275,741}	III	C

HLA, human leucocyte antigen.