



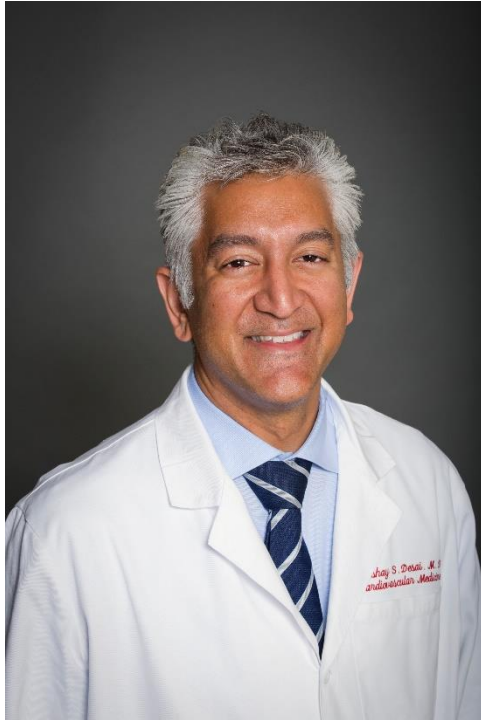
Brigham and Women's Hospital
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Cardiology Clinical Pearls for the Boards

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- **Clinical focus:** Management of Advanced Heart Failure, Cardiac Transplantation
- **Research focus:**
 - Optimization of Heart Failure Disease Management
 - Clinical Trials of Novel Heart Failure Therapies
 - Management of Heart Failure with Preserved EF
 - Remote Monitoring

Disclosures

- **Consulting: Abbott, Alnylam, AstraZeneca, Avidity Biosciences, Axon Therapies, Bayer, CVS Caremark, Edwards Lifesciences, Endotronix, iRhythm Technologies, Medpace, New Amsterdam, Novartis, Regeneron, River2Renal, Roche, Vectorious Medical, Verve Therapeutics, Volta Medical, Whiteswell.**
- **Research Grants: AstraZeneca, Alnylam, Avalyn, Bayer, Intellia, Novartis, Pharmacosmos**

General Principles

- **Board exams test areas of ‘settled law’, not controversy**
- **Know the Guidelines**
- **Don’t Overthink**
- **Pay attention to clues in physical exam**
- **Know your pharmacology**

Prevention: Core Concepts

- **Healthy Lifestyle Guidance for ALL**
- **Systematically Assess CV Risk**
- **Match intensity of preventive interventions to level of CV Risk**

Dietary Guidance to reduce CV Risk

- **Emphasize intake of vegetables, fruits, legumes, nuts, whole grains, and fish**
- **Replace saturated fat with monounsaturated and polyunsaturated fats**
- **Mediterranean-Style diet associated with ~30% reduction in CV risk in MI/Stroke/CVD (PREDIMED)**
- **Reduction in total fat (and replacing with carbs) likely not helpful (WHI)**

Key Take Home Points from the new BP Guidelines

- **High blood pressure is the most prevalent and modifiable risk factor for MI, stroke, heart failure, AF, dementia, CKD, and death**
- **The guidelines rely on the PREVENT-CVD* risk prediction tool to define who should be treated ($\geq 7.5\%$ 10-year risk defines you as “high risk”)**
- *** PREVENT-CVD score includes both ASCVD risk and heart failure risk**

Blood pressure definitions

Category	Blood Pressure (mm Hg)	Intervention
Normal	<120 / <80	
Elevated	120-129 / <80	Lifestyle interventions
Hypertension (Stage 1)	130-139 / 80-89	Lifestyle + Single drug therapy with thiazide, dihydropyridine CaCB or ACEi or ARB
Hypertension (Stage 2)	≥ 140 / ≥ 90	Lifestyle + Combination therapy with 2 first line agents from different classes, ideally in a single pill combination

- Treatment goal is < 130/80 mm Hg for everyone
- Encouragement to achieve <120 mm Hg if high risk

<https://doi.org/10.1161/HYP.0000000000000264>

Starting pharmacotherapy

- **Start pharmacotherapy for BP in everyone with BP ≥ 140 / ≥ 90 mm Hg**
- **Start pharmacotherapy for BP in people with BP $\geq 130/\geq 80$ IF**
 - **They have established CVD**
 - **Their PREVENT score is $\geq 7.5\%$ 10-year risk**
 - **They have diabetes or CKD**
 - **If the PREVENT score is $<7.5\%$ they can have a 6-month "lifestyle" grace period, then start pharmacotherapy**

Mapping the Old to the New when LDL-C 70 to 189 mg/dL

Risk	PCE Risk Category	PREVENT Risk Category 10-year ASCVD risk	Intervention and Goal
Low	<5%	0 to 3%	Lifestyle
Borderline	5 to <7.5%	3 to <5%	Consider therapy, goal LDL < 100 mg/dL
Intermediate	≥7.5 to <20%	5 to <10%	LDL lowering therapy, Goal LDL < 100 mg/dL
High	≥20%	≥10%	LDL lowering therapy, Goal LDL < 70 mg/dL
Established ASCVD	N/A	N/A	LDL lowering therapy, Goal LDL < 55 mg/dL

LDL-lowering therapy generally is max tolerated statin, ezetimibe, PCSK9i mAb, or bempedoic acid

Circulation. 2026;153:e1154–e1276. DOI: 10.1161/CIR.0000000000001423

Risk Enhancers not accounted for by PREVENT

Table 13. Risk Enhancers

Risk Enhancers
History of premature ASCVD in a parent or sibling (onset age <55 y for men, <65 y for women)
Higher risk ancestry (eg, South Asian, Filipino)
High polygenic risk (if measured) (Section 4.2.3.5, "Polygenic Risk Scores")
Chronic inflammatory diseases (eg, systemic lupus, rheumatoid arthritis, advanced psoriasis, inflammatory arthritis)
Lp(a) ≥ 125 nmol/L or ≥ 50 mg/dL
hsCRP ≥ 2 mg/L on >1 occasion (if measured)
TG persistently ≥ 175 mg/dL (2 mmol/L) (if nonfasting) and ≥ 150 mg/dL (1.7 mmol/L) (if fasting)
CKM syndrome
LDL-C persistently ≥ 160 – 189 mg/dL (4.1–4.9 mmol/L), non-HDL-C ≥ 190 – 219 mg/dL or apoB ≥ 120 mg/dL*
Reproductive risk markers (premature menopause, preeclampsia, gestational diabetes, gestational hypertension, preterm delivery; Section 4.2.3.4, "Reproductive Risk Marker")

Table 14. Reproductive Risk Markers Associated With ASCVD Events

Adverse Pregnancy Outcomes* That Have a Stronger Association With ASCVD Events ¹⁴
Hypertensive disorders of pregnancy (preeclampsia, gestational hypertension)
Gestational diabetes
Small-for-gestational age ²³ (birthweight below the 10th percentile ²⁴)
Preterm delivery (before 37 wk gestation)
Recurrent spontaneous pregnancy loss
Other Reproductive Risk Markers ¹¹
Early menarche (<10 y old) ²⁵
Early menopause (<45 y old), ¹⁸ especially premature menopause (<40 y old) ^{18,21}
Polycystic ovarian syndrome and irregular menses ^{26,27}

*See reference for a full list of Adverse Pregnancy Outcomes.²⁸
 ASCVD indicates atherosclerotic cardiovascular disease.

Consider aspirin use among those...

- Who are at elevated risk ($\geq 20\%$ 10-year risk) among whom the absolute CV benefit may be worth the risk of bleeding**
- Who are at high risk for colorectal cancer**
- Who are concerned about MI risk but less concerned about bleeding risk**
- Among those who have a CAC score ≥ 100**

Acute Coronary Syndromes

- **ECG within 10 minutes of presentation**
 - STE or LBBB not known to be old
 - ST depression ≥ 0.5 mm; TWI >1 mm
 - Coronary distribution
- **Hs-troponin at presentation and again in 1-3 hours (examine absolute values and change)**

ST-Elevation MI (STEMI)

- Consider immediate reperfusion therapy
- In whom?
 - Within 12 hrs of sx onset, or
 - 12-24 hrs after sx onset if clinical or ECG evidence of ongoing ischemia
- How?
 - Primary PCI (including transfer to PCI-capable hosp if door-in to door-out time will be <30 min & 1st med contact to PCI anticipated <120 min)
 - Fibrinolytic (barring contraindications*)

** COMPLETE revascularization
of non-culprit lesions within 6
weeks favored*

*Absolute: prior ICH; intracranial neoplasm, aneurysm, or AVM; stroke or head trauma w/in 3 mos; active internal bleeding or diathesis; suspected AoD

*Relative: severe HTN; stroke; prolonged CPR; recent bleed, surgery or trauma; noncompressible vasc puncture; pregnancy; current use of anticoagulants

NSTEMI: Early Invasive vs. Ischemia-Guided Strategy based on Risk

Immediate (w/in 2 h)	Early Invasive (w/in 24 h)	Delayed Invasive (w/in 25-72 h)	Ischemia-Guided
• Refractory angina • Signs or symptoms of HF or new or worsening MR • Recurrent angina or ischemia at rest or with low-level activity despite intensive med Rx	• GRACE score >140 • Temporal Δ in Tn • New or presumably new ST depression	• TIMI Risk Score ≥ 2 • GRACE score >109-140 • Diabetes • GFR <60 mL/min/1.73m² • EF <0.40 • Early postinfarction angina • PCI w/in 6 mo • Prior CABG	• TIMI Risk Score 0-1 • GRACE score <109 • Low-risk Tn-neg female patient • Patient or clinician preference in absence of high-risk features

Medical Therapy in ACS/NSTEMI

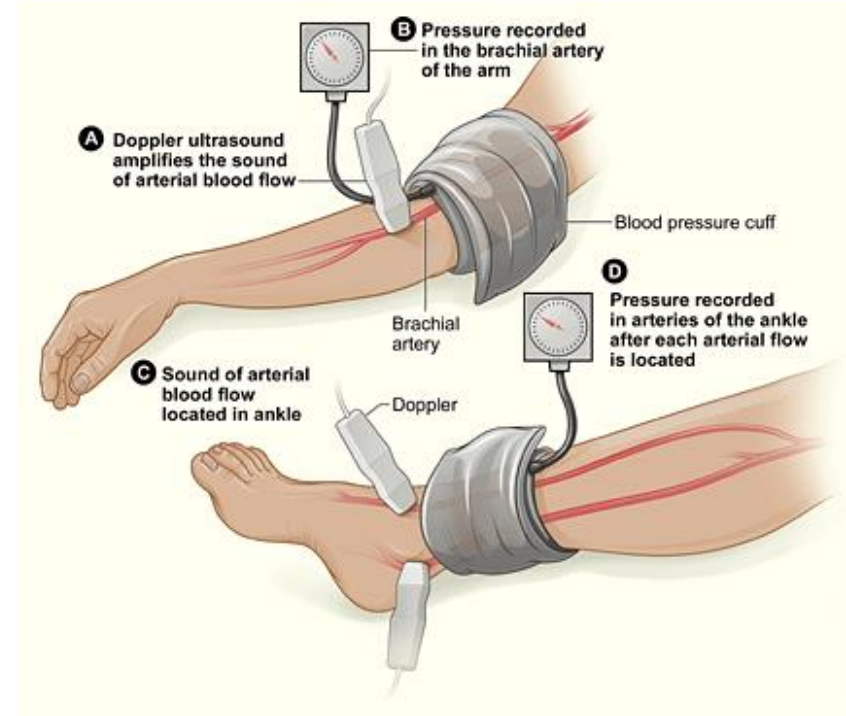
- Aspirin for all
- Oxygen/Nitrates/Oral Beta-blockers (not morphine!)
- Add P2Y₁₂ ADP Receptor Blocker for most (ticagrelor or prasugrel preferred over clopidogrel)
- Weight based-Unfractionated Heparin for most, LMWH if conservatively managed, and bivalirudin if invasively managed and high bleeding risk

Long Term Therapy

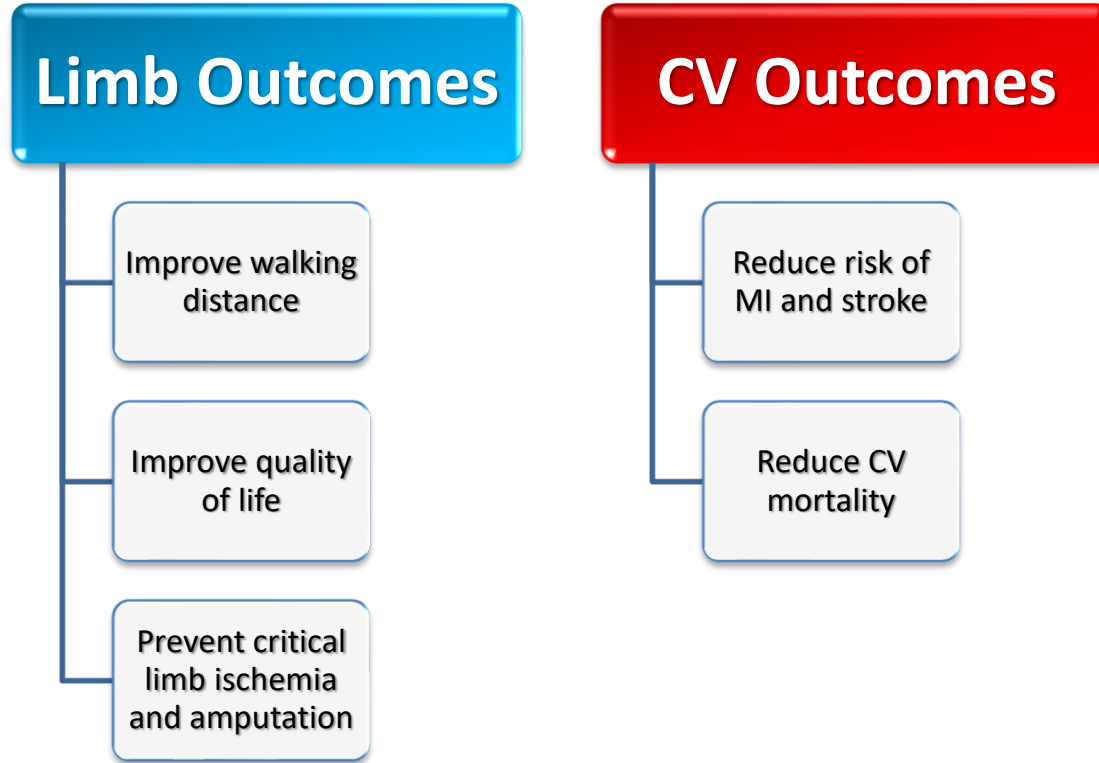
- ASA (maybe drop after 1-3 mos) + P2Y₁₂ inhibitor (ideally ticag or prasugrel; at least 12 mos)
- Statin ± EZE ± PCSK9i if needed
- β-blocker (if low LVEF or STEMI)
- ACEI (if low LVEF, HTN, DM, CKD); MRA (if low LVEF + either HF or DM, and Cr & K okay)
- Diabetes: cardiorenal protective Rx (GLP-1RA and/or SGLT2i)
- Overweight or obese: GLP-1RA

Ankle:Brachial Index

- The ankle:brachial index (ABI) is calculated by dividing each of the systolic pressures in the ankle (DP and PT) by the highest brachial pressure.
- 95% sensitive and 99% specific for PAD
- Identifies a population at high risk of CV events



PAD: Goals of Therapy



PAD Risk-reduction Therapies

- Lifestyle modifications
- Smoking Cessation
- Diabetes mellitus
 - HbA_{1c} goal < 7% to reduce microvascular complications
 - GLP-1 , SGLT2 inhibitors but caution with canagliflozin
- Dyslipidemia
 - High intensity statin + other agents (lower LDL is better)
- Hypertension
 - Therapies to achieve target < 130/80, ACE inhibitors preferred
- Antithrombotic therapy
 - Antiplatelet monotherapy (symptomatic), preference for P2Y₁₂ inhibition
 - DAPT if high risk and low bleeding risk

**Structured Exercise
program for
symptomatic
claudication**

AAA: Summary Points

- Screen for AAA (exam + U/S) in
 - Men > 60 who are siblings or offspring of patients with AAA
 - Men 65-75 who have ever smoked
- Intervene for symptomatic patients or according to maximal diameter
 - ≥ 5.5 cm $\rightarrow$ Repair
 - 4.0-5.5 cm $\rightarrow$ Surveillance q 6-12 mos
 - < 4.0 cm $\rightarrow$ Surveillance q 2-3 years

Thoracic Aortic Aneurysm

When to Intervene?

- Generally 5.5 cm, or growth > 0.5 cm/y including bicuspid AoV (unless RF for dissection such as FH)
- For genetic syndrome (MFS, LDS, EDS, familial syndrome) may undergo at smaller diameters (4.0-5.0) – for MFS contemplating pregnancy > 4.0 cm
- If aortic valve surgery and > 4.5 cm

Carotid Revascularization

- **Should consider: Symptomatic (nondisabling stroke/TIA) + ipsilateral ICA stenosis > 70% and average or low surgical risk**
- **Reasonable to consider: asymptomatic patients who have >70% ICA stenosis if the risk of perioperative stroke, MI, and death is low.**
- **Carotid Artery Stenting is as an alternative to Surgical Endarterectomy for symptomatic patients at average or low risk of complications.**
- **It is reasonable to choose CAS over CEA when revascularization is indicated in patients with neck anatomy unfavorable for CEA**

Venous Thromboembolism

- **VTE: chronic inflammatory disease, high recurrence rate after discontinuing anticoagulation**
- **Differentiating “provoked” vs. “unprovoked” is no longer relevant**
- **All 4 NOACs are noninferior to LMWH/ warfarin for efficacy, regardless of weight, PE vs. DVT, CKD, and cancer**
- **For extended duration anticoagulation, DOAC more effective than aspirin**
- **VTE recurrence is high in post-hospital period, and may be prevented with extended duration prophylaxis**

Risk Stratification

New Introduction of Clinical Categories



Subclinical

Incidental/
asymptomatic



Symptomatic
low severity

Subsegmental and/or
no clinical or imaging
severity markers



Symptomatic
high severity

Clinical (sPESI),
imaging, or biomarker
severity markers



Respiratory Modifier (R)[†] when
patients meet modifier criteria



Incipient
cardiopulmonary
failure

Transient HoTN, or
lactate+, or low
cardiac index



Cardiopulmonary
failure

Recurrent/persistent
hypotension/
cardiogenic shock

Initial Management

Category A



Early discharge



Initiate DOAC

Category B

Category C



Hospitalization



Initiate LMWH

Category D



ICU



Initiate UFH

Category E

2026 ACC/AHA PE Guidelines

- 1) Incorporate the new detailed PE categories into clinical presentations**
- 2) For parenteral therapy, almost always start with LMWH, not UFH**
- 3) With weight-based LMWH, monitoring anti-Xa levels is rarely useful.**
- 4) High suspicion for normotensive shock; low threshold for ordering lactate levels**
- 5) Extend anticoagulation duration in provoked VTE when risk factors persist**
- 6) Utilize Pulmonary Embolism Response Teams**

'4 Pillars' for Symptomatic HFrEF

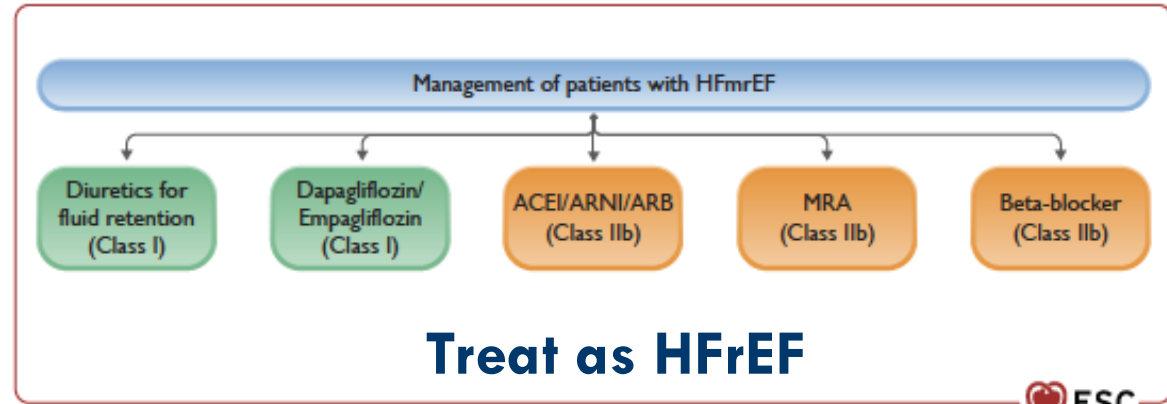


4 Core drugs targeting 5 mechanisms

Additional therapy in specific situations

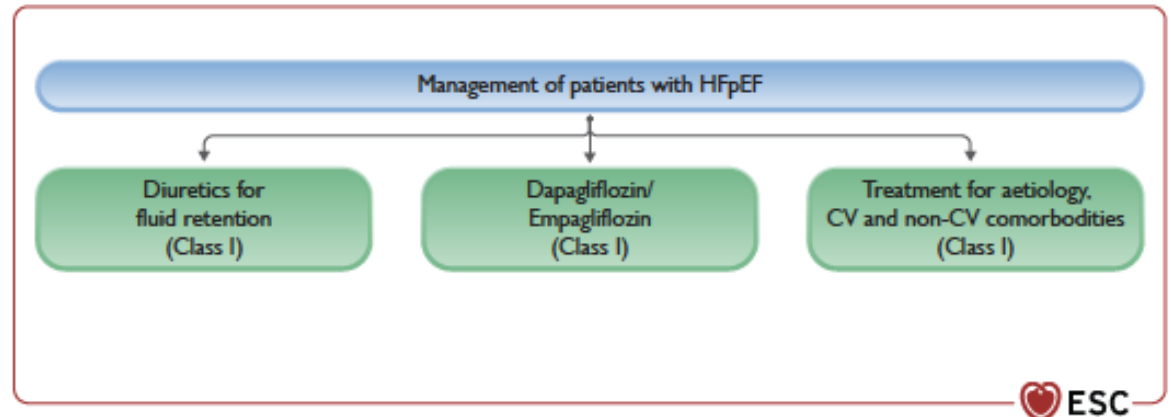
Updated Guidelines for HFmrEF/HFpEF

HFmrEF
(EF 41-49%)



2023 Focused Update of the 2021 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure

HFpEF
EF $\geq$ 50%

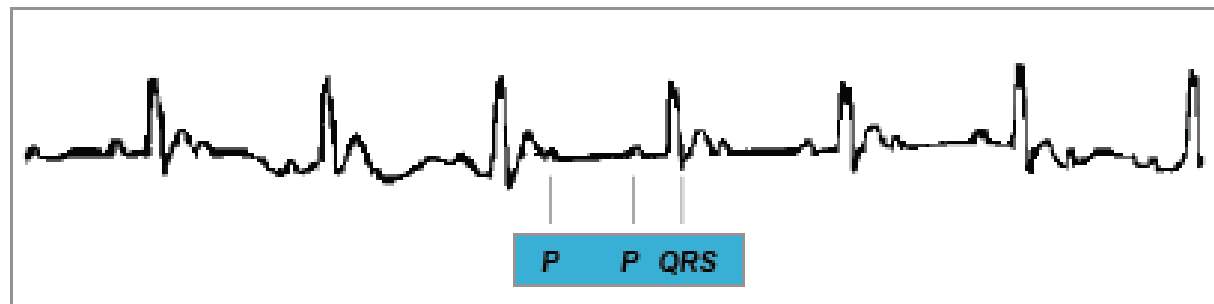


Second-Degree AV Block – Mobitz I (Wenckebach)



- Progressive prolongation of the PR interval until a ventricular beat is dropped
- Level of block usually AV nodal
- Usually does not require PCM

Second-Degree AV Block – Mobitz II



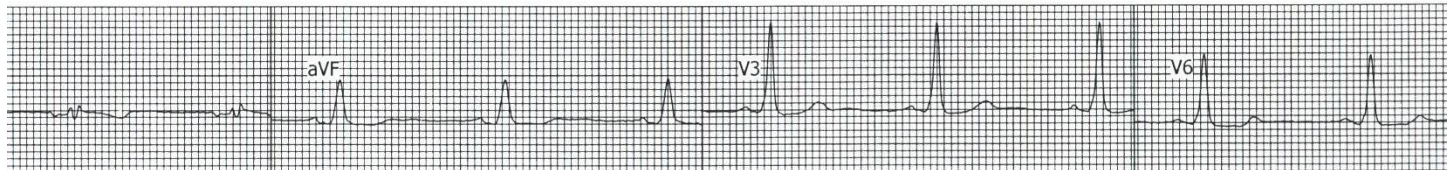
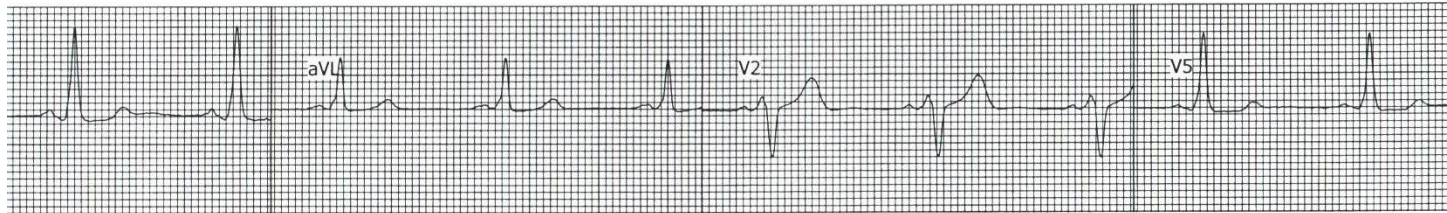
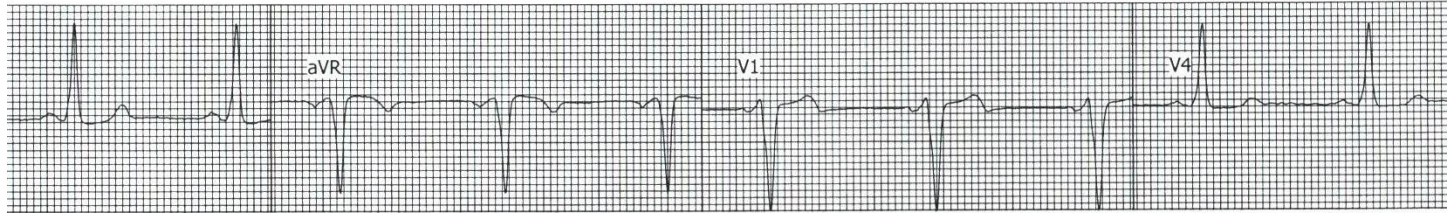
- Sudden dropped ventricular beats
 - No PR prolongation
 - May be marker of His-Purkinje disease
 - Usually evidence of other conduction disease (wide QRS)

Third-Degree AV Block



- No impulse conduction from the atria to the ventricles
- Ventricular escape usually regular
- AV dissociation with atrial rate **FASTER** than ventricular rate
- AV dissociation with atrial rate **SLOWER** than ventricular rate is not heart block

18 year old male with palpitations



Management of Atrial Fibrillation

- **Treat predisposing factors**
- **Prevent thromboembolism / stroke**
- **Rate control (target HR<110 bpm)**
- **Restore/maintain sinus rhythm?**

CHADS2-Vasc Score for Stroke in AF

<u>Risk Factors</u>	<u>Score</u>
Congestive HF	1
Hypertension	1
Age > 75 yrs	2
Diabetes mellitus	1
Prior stroke or TIA	2
Vascular Disease	1
Age 65 – 75	1
Sex category = female	1

Implications of the Score

0 = stroke risk 1.2%/yr

- Rx: no oral anticoagulation or asa

1 = stroke risk 2.2%/yr

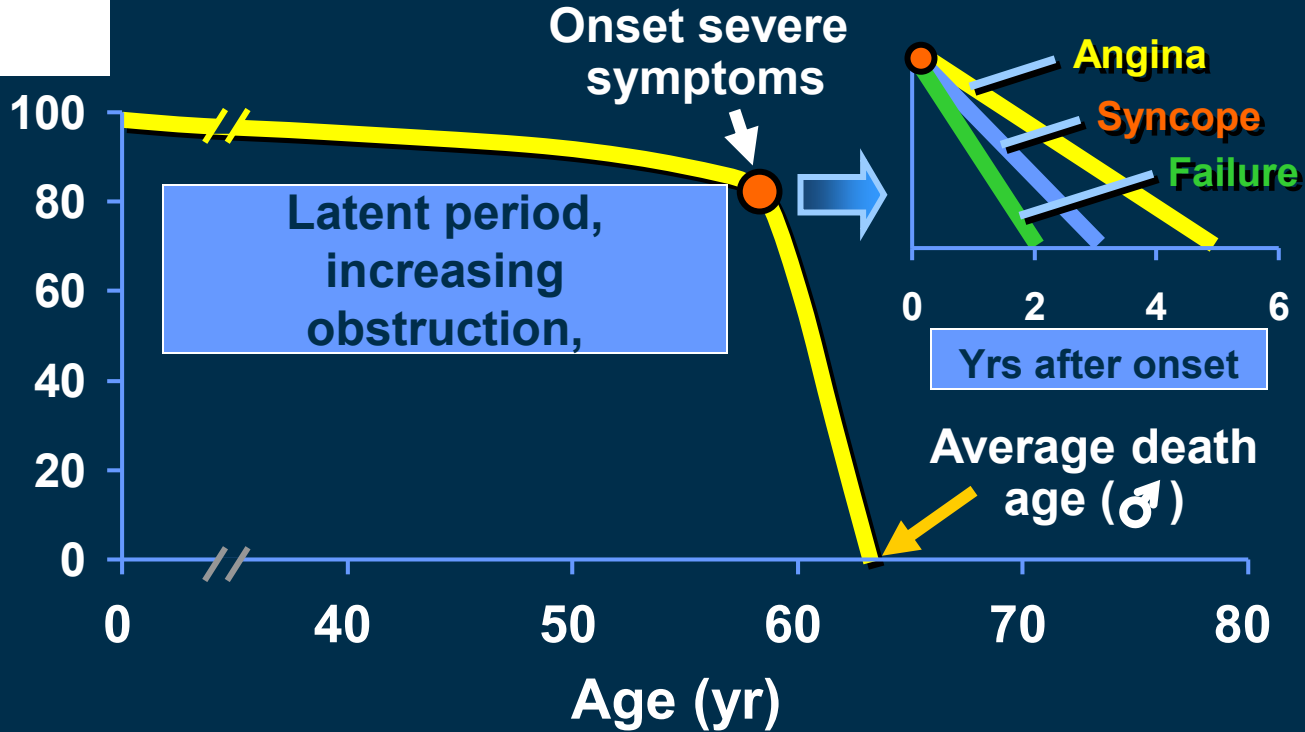
- Rx oral antiicoagulant or asa

2 or more = stroke risk >3% / yr

- Rx oral anticoagulant

Earlier onset in
bicuspid AoV
(associated
aortopathy)

Natural History of Aortic Stenosis



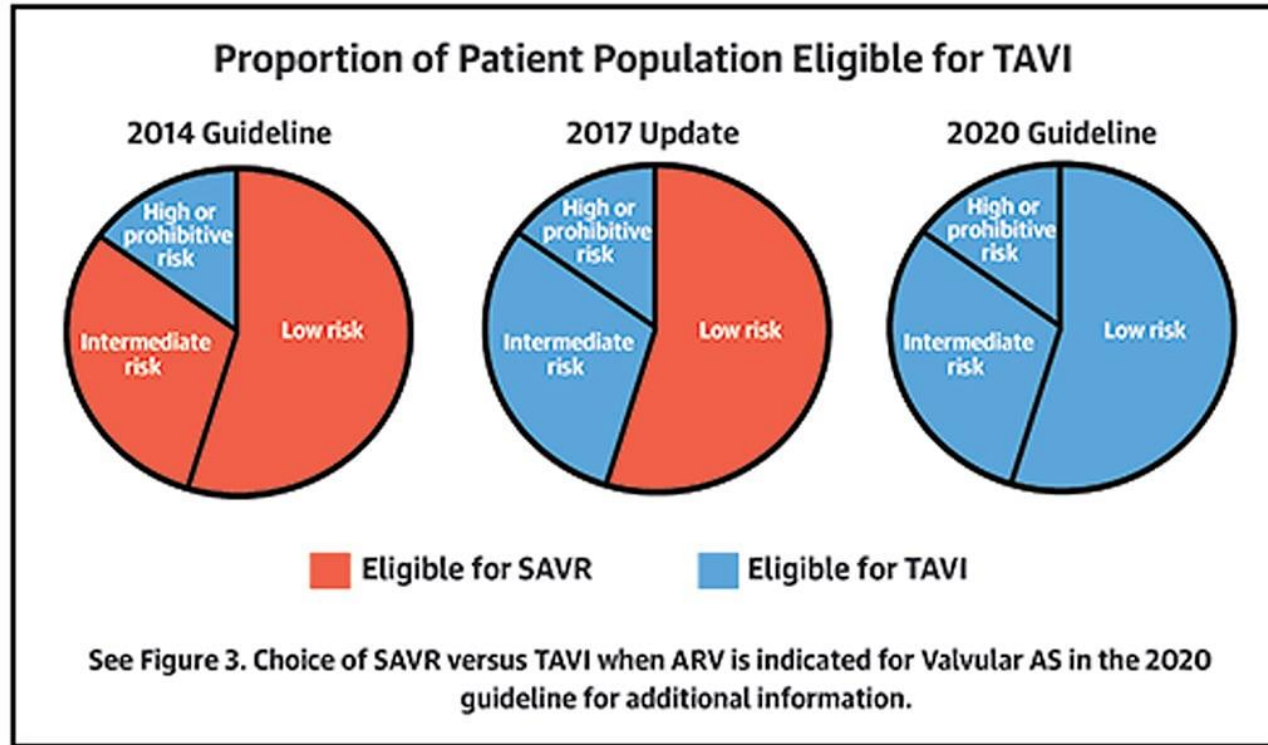
Ross J Jr. and Braunwald E: *Circ* 38(Suppl 5):61, 1968

Aortic Stenosis

Classification of Severity

	<u>MILD</u>	<u>MODERATE</u>	<u>SEVERE</u>
Jet Velocity (m/s)	< 3.0	3.0 - 4.0	> 4.0
Mean Gradient (mmHg)	< 25	25-40	> 40
Valve Area (cm ²)	> 1.5	1.0-1.5	< 1.0
Valve Area Index (cm ² /m ²)			< 0.6

TAVI is appropriate for an increasing proportion of patients



Endocarditis Prophylaxis

Endocarditis Prophylaxis	Recommendation	Level of Evidence
Prosthetic cardiac valve or prosthetic material for valve repair (including TAVR)	Ila	C-LD
Previous infective endocarditis	Ila	C-LD
Unrepaired <u>cyanotic</u> congenital heart disease (CHD)	Ila	C-LD
Repaired CHD with prosthetic material, first 6 months	Ila	C-LD
Repaired CHD with residual defects at site of patch or device	Ila	C-LD
Cardiac transplant with valve regurgitation due to structurally abnormal valve	Ila	C-LD

For dental procedures that involve manipulation of either gingival tissue or the periapical region of teeth or perforation of the oral mucosa.

Otto et al. 2020 ACC/AHA Guideline for the Management of Valvular Heart Disease



ATRIAL SEPTAL DEFECT

- Types: secundum, primum, sinus venosus, coronary sinus
- Exam: Grade 2 MSM, **fixed splitting S2**
- ECG: IRBB. LAD = primum.
- ECHO: RV volume overload, shunt flow, associated findings (MVP, cleft MV, APVD)

PATENT FORAMEN OVALE

- Present in 25-30% of population
- Sometimes associated with interatrial septal aneurysm
- Implied role in
 - Cryptogenic stroke
 - Migraine
 - Platypnea-orthodeoxia
 - Decompression sickness
- No role for routine closure in stroke

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