

# Take Home Messages and Clinical Pearls for the Boards

Akshay S. Desai MD, MPH

Medical Director | Cardiomyopathy and Heart Failure

Cardiovascular Division | Brigham and Women's Hospital

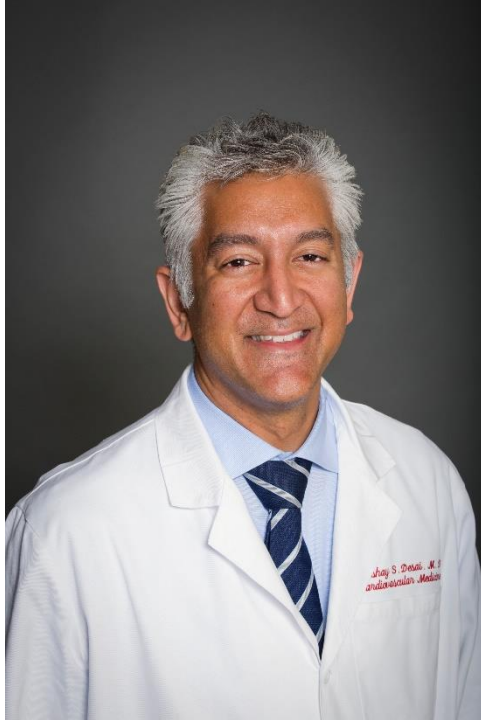
Deputy Editor | *Journal of the American College of Cardiology: Heart Failure*

Professor of Medicine | Harvard Medical School



Mass General Brigham

# Akshay S. Desai, M.D., M.P.H.



- **Medical School:** Harvard Medical School
- **Medicine Residency:** Brigham and Women's Hospital
- **Cardiovascular Fellowship:** Brigham & Women's Hospital
- **Heart Failure Fellowship:** Brigham & Women's Hospital
- **Director, Cardiomyopathy and Heart Failure Program, Cardiovascular Division, Brigham and Women's Hospital**
- **Professor of Medicine, Harvard Medical School**
- **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

- **Research Grant Support (to BWH) from Abbott, Alnylam, AstraZeneca, Bayer, Novartis, Pfizer**
- **Personal Consulting Fees from Abbott, Alnylam, AstraZeneca, Avidity Biopharma, Axon Therapies, Bayer, Biofourmis, Boston Scientific, Endotronix, GlaxoSmithKline, Medpace, Merck, Medtronic, Novartis, Regeneron, River2Renal, Roche, scPharmaceuticals, Volta Medical, Veristat**



# 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**

# AHA Life's Simple 7



## Life's Simple 7

1. Get Active
2. Eat Better
3. Lose Weight
4. Stop Smoking
5. Control Cholesterol
6. Manage Blood Pressure
7. Reduce Blood Sugar

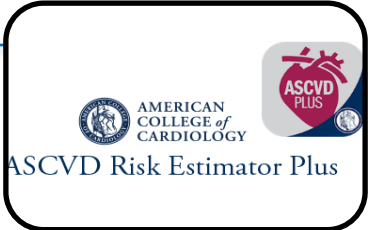
1.  $\geq 150$  minutes moderate activity /week  
or  $\geq 75$  minutes vigorous activity/week
2. Eat a healthy diet (4-5 components of healthy diet score\*)
3. Have a normal body weight (BMI < 25)
4. Never smoked or quit >1 year ago
5. Total cholesterol <200 mg/dL
6. Blood pressure <120/80 mm Hg
7. Fasting blood glucose <100 mg/dL

\* 1) 4.5 cups or more of fruits and vegetables per day 2) two or more 3.5-oz servings of fish per week 3) three servings per day of whole grains 4) less than 1500 mg of sodium per day 5) 36 ounces or less of sugar-sweetened beverages per week

# 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)**

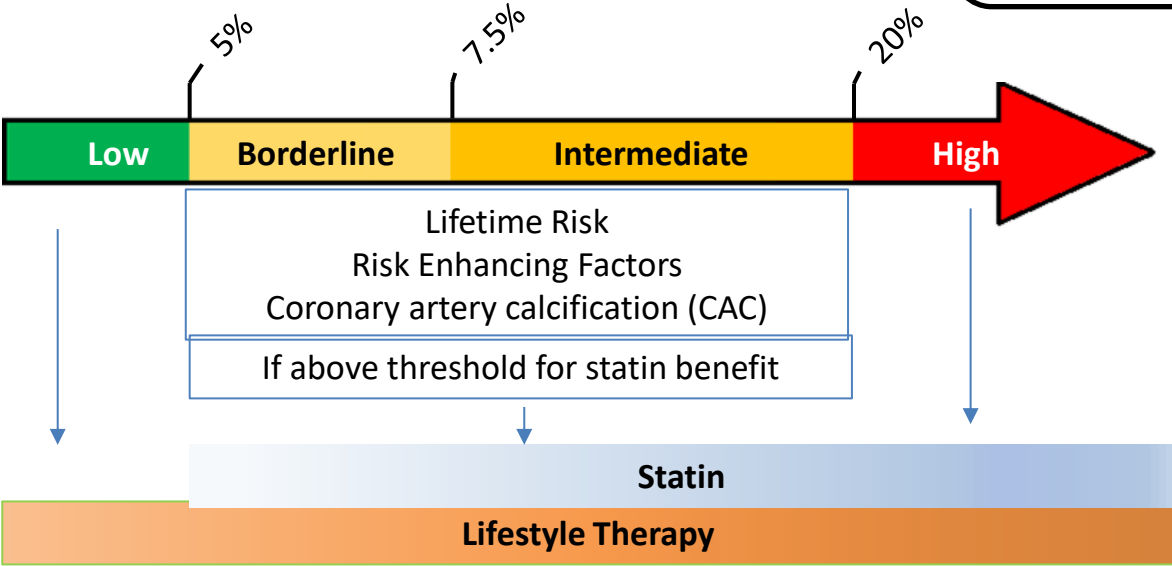


# 2019 AHA/ACC Cardiovascular Risk Assessment: Summary

Clinical ASCVD, or  
 LDL-C  $\geq 190$  mg/dL, or  
 Diabetes, age 40-75, LDL-C 70-189 mg/dL

↓  
 Statin & Lifestyle Therapy

No Clinical ASCVD, primary prevention  
 Calculate 10-year ASCVD risk\*



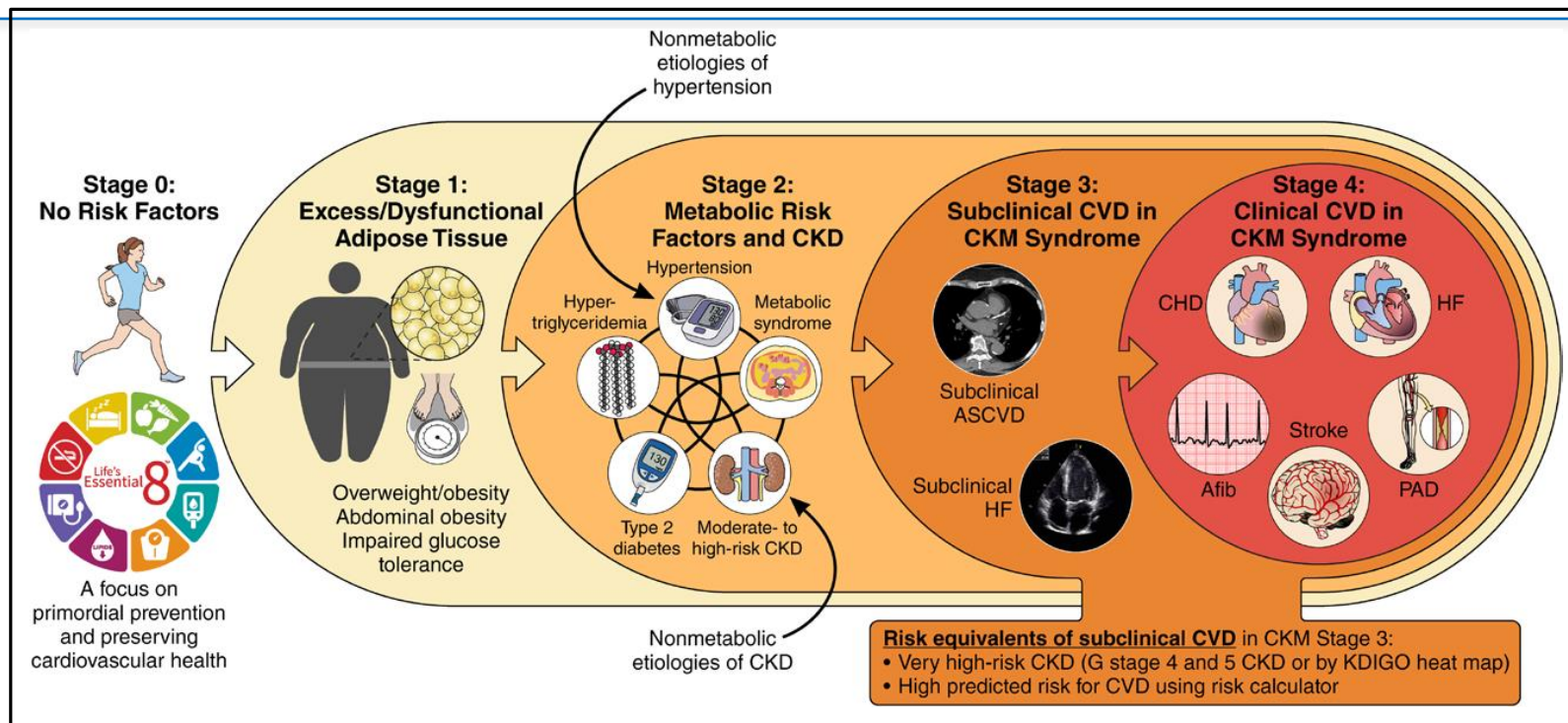
## All patients with ASCVD

- Primary
  - $\geq 50\%$  reduction in LDL-C
- Secondary (may consider)
  - LDL-C  $< 70$  mg/dL
  - Non-HDL-C  $< 100$  mg/dL

\* using the Pooled Cohort Equations in adults 40-79 y (ASCVD Risk Estimator/**PREVENT Score**)



# CKM (Cardiovascular Kidney Metabolic) Risk



**Figure 1. Stages of CKM syndrome.**

# Risk Enhancing Factors: Consider therapy for those at intermediate risk with a risk enhancer

Risk Enhancing Factors	
Family history of premature CAD (men < 55, women <65)	eGFR 15-59 ml/min/1.73m <sup>2</sup>
LDL-C, 160-189 mg/dL Non-HDL-C 190-219 mg/dL	Triglycerides ≥175 mg/dL
Low HDL-C	hsCRP ≥ 2.0 mg/L
Hypertension	Elevated Lp(a) (≥ 50 mg/dL or ≥ 125 nmol/L)
Hyperglycemia	Abdominal obesity
ABI < 0.9	Chronic inflammatory conditions (RA, psoriasis, HIV)
High Apo B (≥130 mg/dL)	History of premature menopause
Low SES	South Asian ancestry

**Table 2. Risk-Enhancing Factors for CKM Syndrome\***

Chronic inflammatory conditions (eg, psoriasis, RA, lupus, HIV/AIDS)
High-risk demographic groups (eg, South Asian ancestry, lower socioeconomic status)
High burden of adverse SDOH
Mental health disorders (eg, depression and anxiety)
Sleep disorders (eg, obstructive sleep apnea)
Sex-specific risk enhancers (beyond gestational diabetes consideration in stage 1)
History of premature menopause (age <40 y)
History of adverse pregnancy outcomes (eg, hypertensive disorders of pregnancy, preterm birth, small for gestational age)
Polycystic ovarian syndrome
Erectile dysfunction
Elevated high-sensitivity C-reactive protein (≥2.0 mg/L if measured)
Family history of kidney failure; family history of diabetes

CKM indicates cardiovascular-kidney-metabolic; RA, rheumatoid arthritis; and SDOH, social determinants of health.

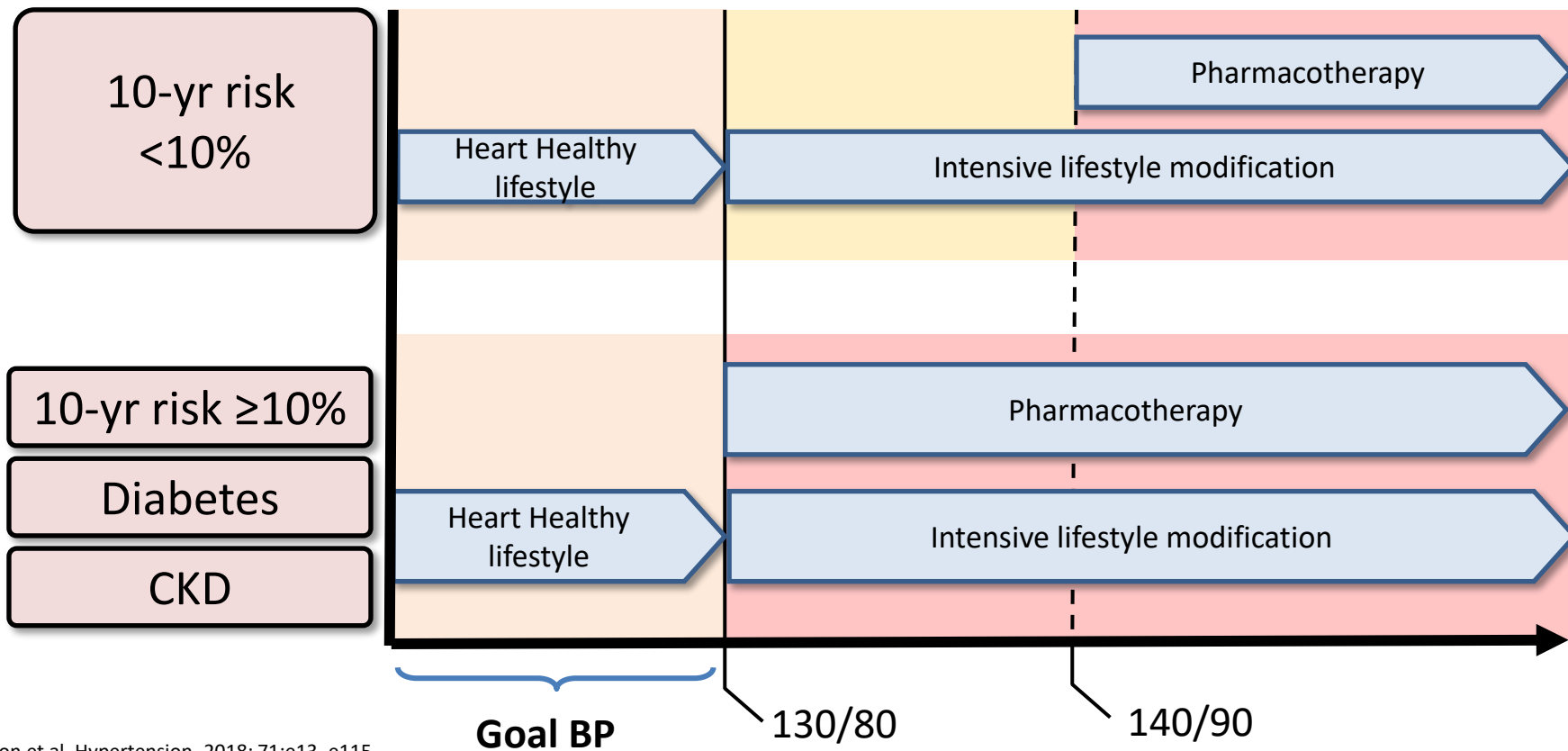
\*These factors increase the likelihood of progression along CKM stages with associated risk for cardiovascular disease and kidney failure.

# 2017 ACC/AHA Blood Pressure Guidelines

<i><b>SBP</b></i>		<i><b>DBP</b></i>	<i><b>2003 JNC7</b></i>	<i><b>2017 ACC/AHA</b></i>
<i><b>&lt;120</b></i>	<i><b>and</b></i>	<i><b>&lt;80</b></i>	Normal BP	Normal BP
<i><b>120–129</b></i>	<i><b>and</b></i>	<i><b>&lt;80</b></i>	Prehypertension	Elevated BP
<i><b>130–139</b></i>	<i><b>or</b></i>	<i><b>80–89</b></i>	Prehypertension	Stage 1 hypertension
<i><b>140–159</b></i>	<i><b>or</b></i>	<i><b>90–99</b></i>	Stage 1 hypertension	Stage 2 hypertension
<i><b>≥160</b></i>	<i><b>or</b></i>	<i><b>≥100</b></i>	Stage 2 hypertension	Stage 2 hypertension

- Blood Pressure should be based on an average of  $\geq 2$  careful readings on  $\geq 2$  occasions
- Adults with SBP or DBP in two categories should be designated to the higher BP category

# 2017 ACC/AHA Blood Pressure Guidelines



# Aspirin in Primary CV Prevention

Recommendations for Aspirin Use		
COR	LOE	Recommendations
IIb	A	1. <b>Low-dose</b> aspirin (75-100 mg orally daily) might be considered for the primary prevention of ASCVD among select adults <b>40 to 70 years</b> of age who are at <b>higher ASCVD risk but not at increased bleeding risk.</b>
III: Harm	B-R	2. Low-dose aspirin (75-100 mg orally daily) should not be administered on a routine basis for the primary prevention of ASCVD among adults >70 years of age.
III: Harm	C-LD	3. Low-dose aspirin (75-100 mg orally daily) should not be administered for the primary prevention of ASCVD among adults of any age who are at increased risk of bleeding.

# Acute Coronary Syndromes

---

- **ECG within 10 minutes of presentation**
  - STE or LBBB not known to be old
  - ST depression  $\geq 0.5$  mm; TWI  $> 1$  mm
  - Coronary distribution
- **Hs-troponin at presentation and again in 1-2 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 & 1<sup>st</sup> 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

# 2025 ACC/AHA NSTEACS Guidelines: Early Invasive

Unstable Patients	High- or Intermediate-Risk (based on TIMI Risk Score or GRACE Score)		Lower-Risk
Immediate Angio (w/in 2 h)	Early Invasive (w/in 24 h)	Delayed Invasive (w/in 25-72 h)	Routine or Selective Invasive
<ul style="list-style-type: none"> <li>• Cardiogenic shock</li> <li>• Signs or symptoms of HF or new or worsening MR</li> <li>• Refractory angina</li> <li>• Hemodynamic or electrical instability</li> </ul>	<ul style="list-style-type: none"> <li>• GRACE score &gt;140</li> <li>• Steeply rising Tn</li> <li>• Ongoing ST-segment <math>\Delta</math>s</li> </ul>	<ul style="list-style-type: none"> <li>• GRACE score 109-140</li> <li>• Stable or downtrending Tn</li> <li>• Absence of ongoing ischemic sx</li> </ul>	<ul style="list-style-type: none"> <li>• TIMI Risk Score 0-1</li> <li>• GRACE score &lt;109</li> <li>• Tn negative</li> <li>• No ECG <math>\Delta</math>s</li> </ul>



# Medical Therapy in ACS/NSTEMI

---

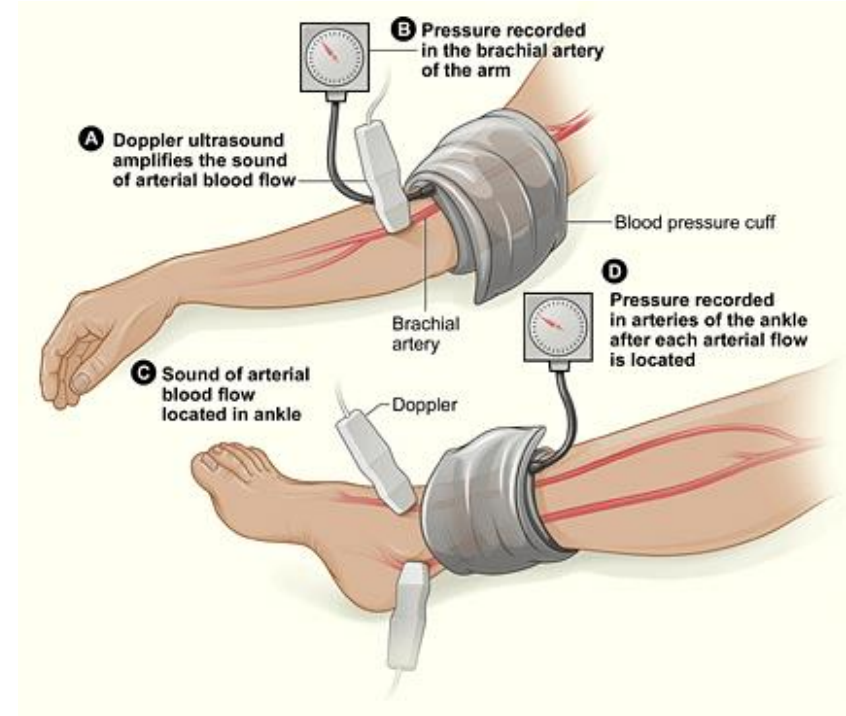
- **Aspirin for all**
- **Oxygen/Nitrates/Oral Beta-blockers (not morphine!)**
- **Add P2Y<sub>12</sub> ADP Receptor Blocker for most (ticagrelor or prasugrel preferred over clopidogrel)**
- **Weight based-Unfractionated Heparin for most, LMWH if conservatively managed, and bivalirudin if invasively managed and high bleeding risk**

# Long Term Therapy

- DAPT ( $\geq 1$  year, longer-term if low bleeding risk)
- Statin (+ Ezetimibe + PCSK9i)
- Beta-blockers
  - If low LVEF or STEMI (after hemodynamic stabilization)
- ACEI (or ARB if cannot tolerate ACEI)
  - LVEF  $<40\%$ , *or*
  - HTN, diabetes, or stable CKD
- MRA
  - If on ACEI/ARB & BB; *and*
  - Cr  $\leq 2-2.5$ , K  $\leq 5$ ; *and*
  - LVEF  $<40\%$ , diabetes, or HF

# 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

## Limb Outcomes

Improve walking distance

Improve quality of life

Prevent critical limb ischemia and amputation

## CV Outcomes

Reduce risk of MI and stroke

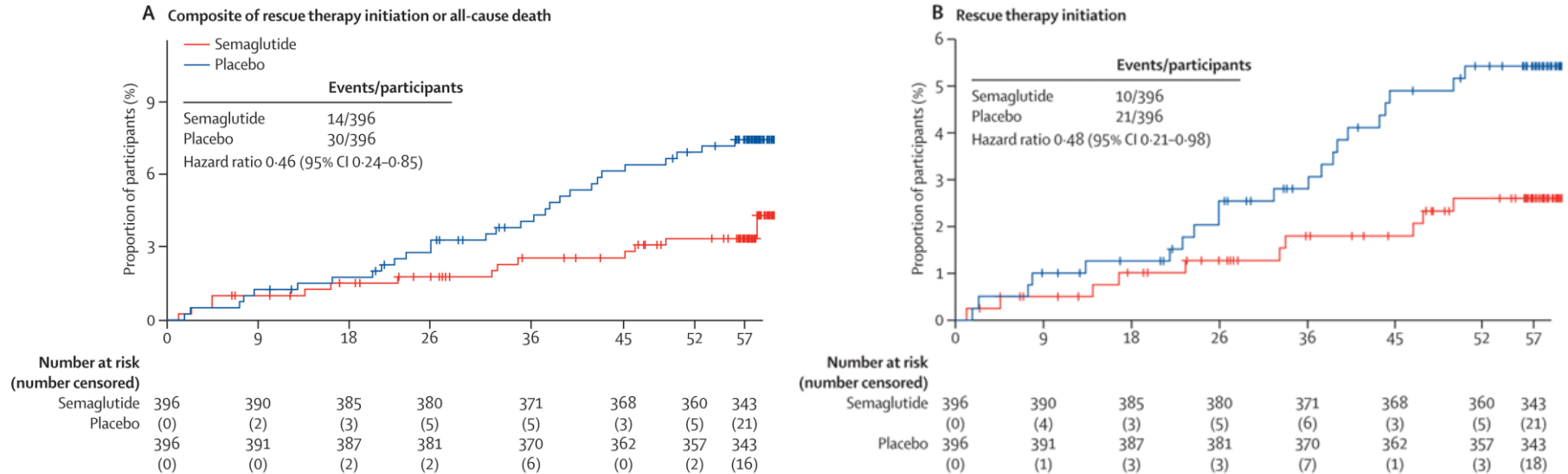
Reduce CV mortality

# PAD Risk-reduction Therapies

- **Lifestyle modifications**
- **Smoking Cessation**
- **Diabetes mellitus**
  - HbA<sub>1c</sub> 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 P2Y<sub>12</sub> inhibition
  - DAPT if high risk and low bleeding risk

**Structured Exercise  
program for  
symptomatic  
claudication**

# Semaglutide and Walking Capacity in People with Symptomatic PAD and Type 2 Diabetes: STRIDE Trial



# 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**
  - **$\geq 5.5$  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**
- **Cancer patients with VTE, DOAC > LMWH (except GI cancers)**
- **VTE recurrence is high in post-hospital period, and may be prevented with extended duration prophylaxis**

# Pulmonary Embolism

**5%**

**10%**

**15%**

**70%**

**High Risk**

**Submassive**

**High: RVD+Tn**

**Submassive**

**Low: RVD or Tn**

**Low Risk**

**Reperfuse:**  
**Lysis/Embo-**  
**lectomy**

**Reperfuse,**  
**Or Watch**  
**And Wait**

**Hospitalize,**  
**Anticoa-**  
**gulate**

**? Early**  
**Discharge;**  
**Anticoa-**  
**gulate**

(ESC Guidelines. European Heart J 2014; 35: 3033-3080)

# **AHA: Factors Favoring PE Reperfusion Rx**

- Lack of improvement/ deterioration
- Clinical distress
- Clot-in-transit
- Severe/ persistent RV strain
- Low cardiac output
- Low bleeding risk
- Good life expectancy

(Circulation 2019; epubl October 4)

## 2021 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure

Developed by the Task Force for the diagnosis and treatment of acute and chronic heart failure of the European Society of Cardiology (ESC)

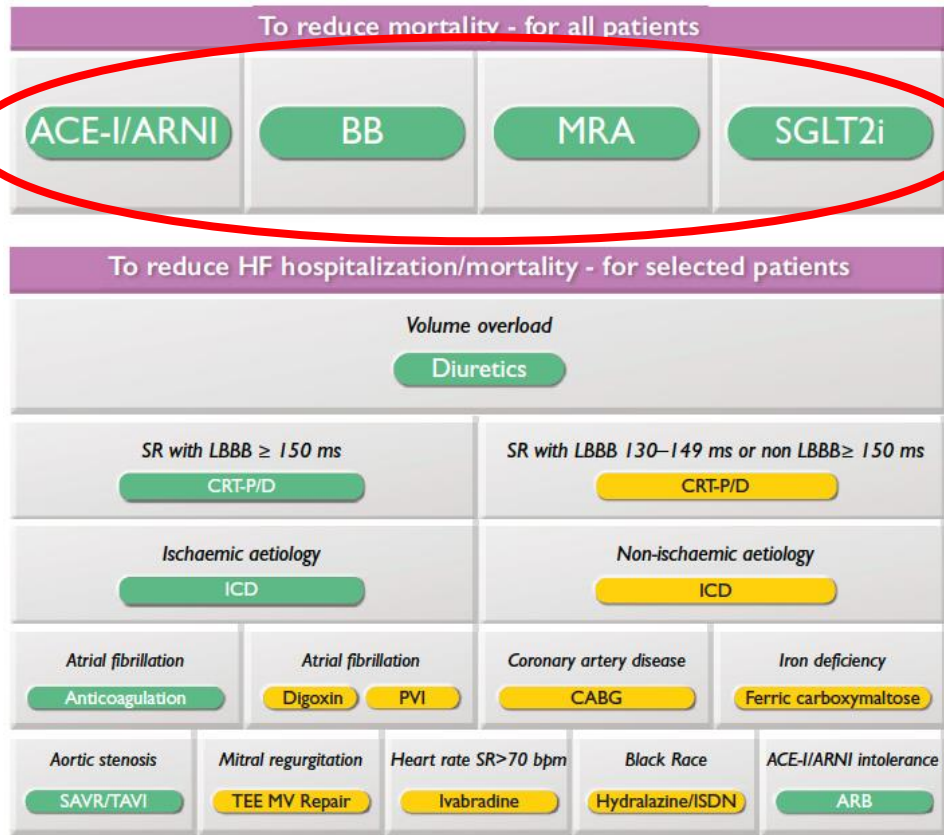
CLINICAL PRACTICE GUIDELINE: FULL TEXT

### 2022 AHA/ACC/HFSA Guideline for the Management of Heart Failure

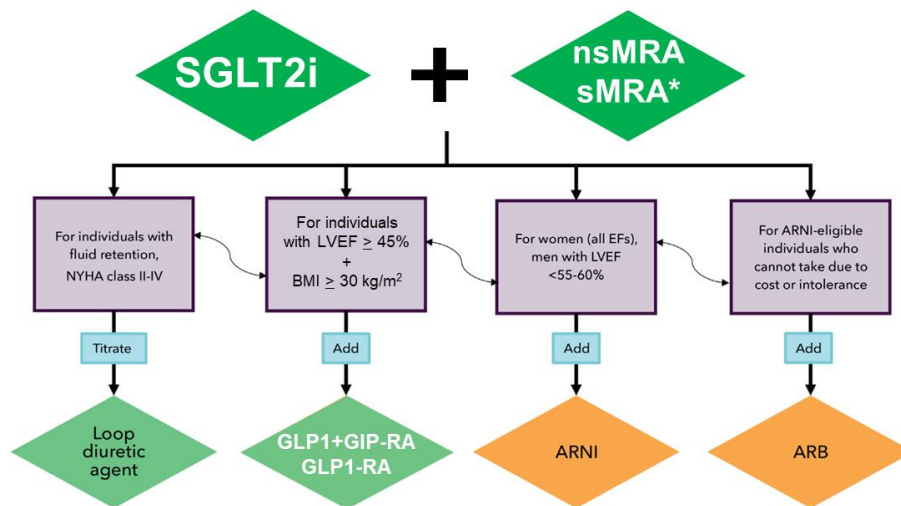
A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines

**Foundational therapy with 4 'Pillars' targeting 5 mechanisms**

## Management of HFrEF



# Medical Therapy of HFpEF is Evolving



**Treat etiology,  
CV and non-  
CV  
comorbidities**

# Summary: Pharmacologic Therapy for HF

## **HFrEF (LVEF $\leq$ 40%)**

- **ARNI $\gg$ ACEi/ARB**
- **Beta-blocker (evidence-based)**
- **MRA**
- **SGLT2i**

## **HFmrEF (LVEF $\leq$ 41-49%)**

- **ARNI $\gg$ ACEi/ARB**
- **Beta-blocker (evidence-based)**
- **MRA**
- **SGLT2i**

## **HFpEF (LVEF $\leq$ 41-49%)**

- **SGLT2i**
- **ARNI if EF $\leq$ 60%**
- **MRA (finerenone > spiro?)**
- **? GLP1-RA**

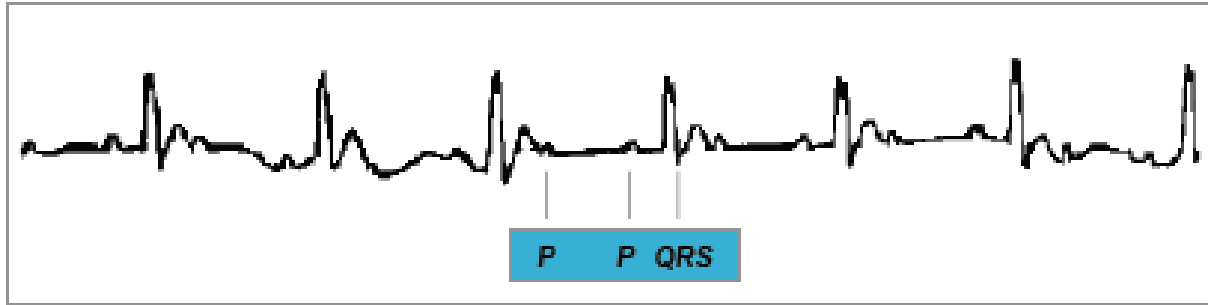
## Second-Degree AV Block – Mobitz I (Wenckebach)



- 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



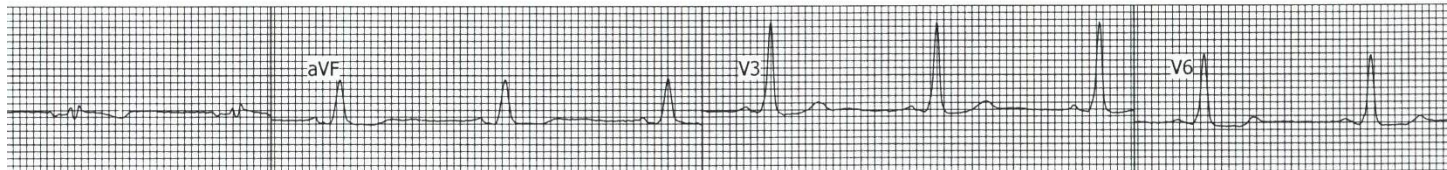
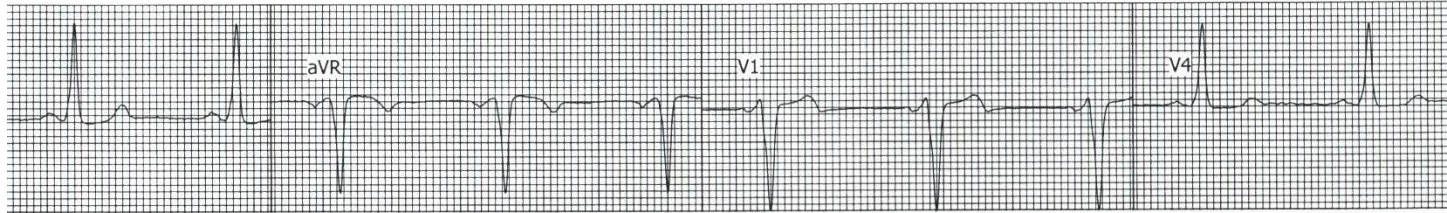
- Sudden dropped ventricular beats
  - No PR prolongation
  - May be marker of His-Purkinje disease
  - Usually evidence of other conduction disease (wide QRS)

# 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

---

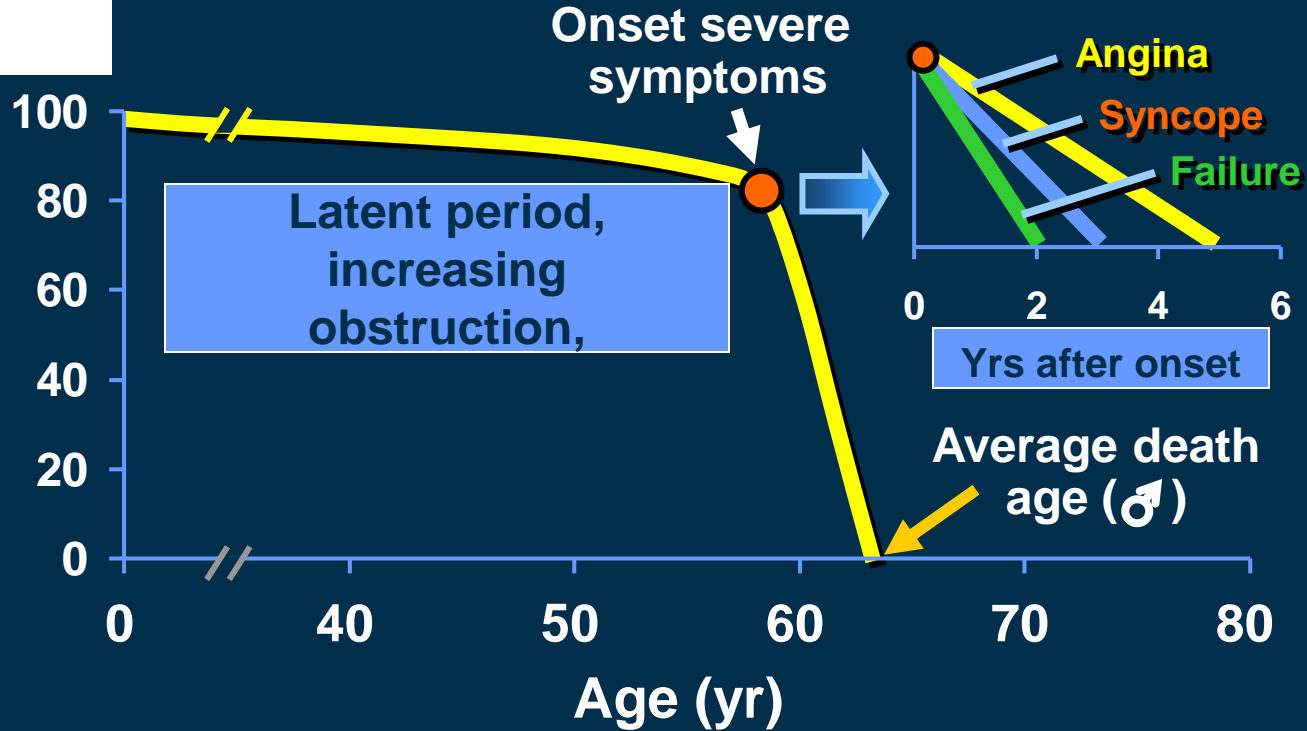
- **Treat predisposing factors**
- **Prevent thromboembolism / stroke**
- **Rate control (target HR<110 bpm)**
- **Restore/maintain sinus rhythm?**

# CHADS2-Vasc Score for Stroke in AF

<u>Risk Factors</u>	<u>Score</u>	
Congestive HF	1	<b><u>Implications of the Score</u></b>  <b>0 = stroke risk 1.2%/yr</b> - Rx: no oral anticoagulation or asa  <b>1 = stroke risk 2.2%/yr</b> - Rx oral antiicoagulant or asa  <b>2 or more = stroke risk &gt;3% / yr</b> - Rx oral anticoagulant
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	

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 <sup>2</sup> )	> 1.5	1.0-1.5	< 1.0
Valve Area Index (cm <sup>2</sup> /m <sup>2</sup> )			< 0.6

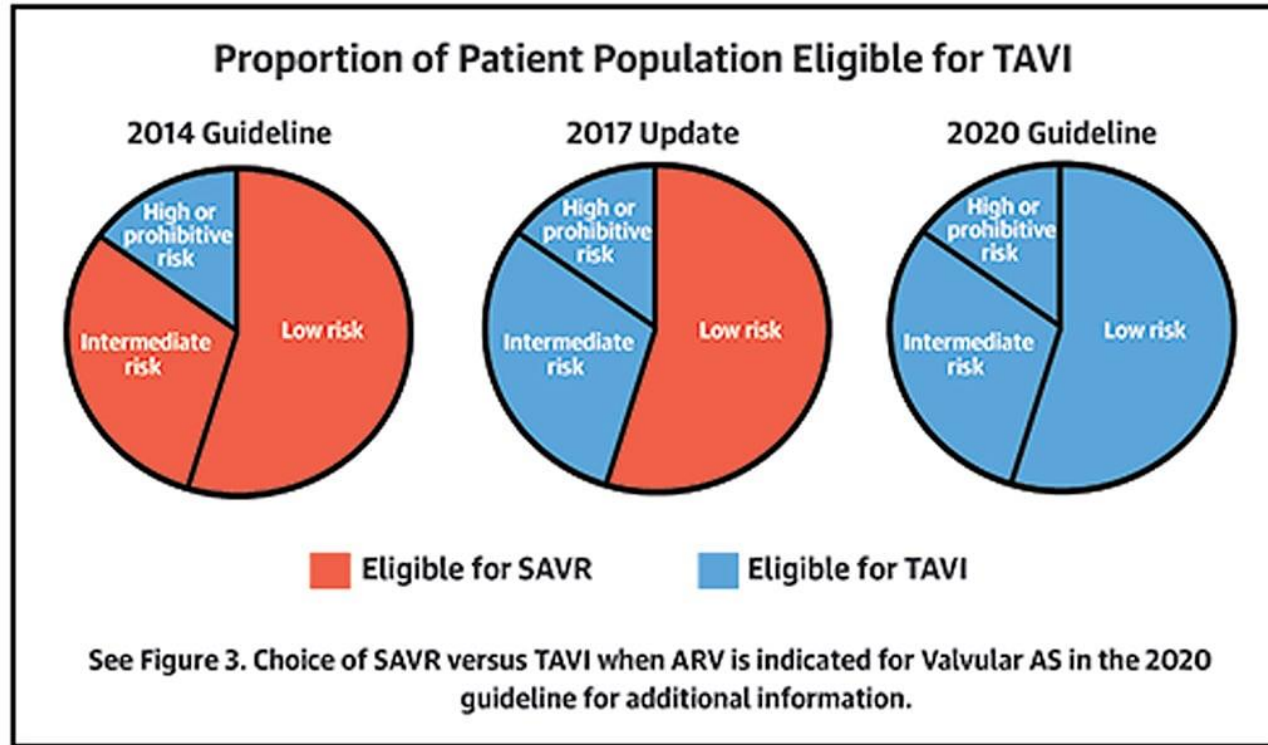
# AS: Severe high gradient vs. severe low gradient

	High gradient	Low gradient, low EF	Low gradient, normal EF
Valve Area (cm <sup>2</sup> )	≤1.0	≤1.0	≤1.0
Jet Velocity (m/s)	≥4	<4	<4
Mean Gradient (mm Hg)	≥40	<40	<40
Valve anatomy	Severe leaflet calcification/ fibrosis or congenital stenosis with severely reduced leaflet opening	Severe leaflet calcification/ fibrosis or congenital stenosis with severely reduced leaflet opening	Severe leaflet calcification/ fibrosis or congenital stenosis with severely reduced leaflet opening
Dobutamine stress echo	N/a	AVA ≤1 with jet velocity ≥4 m/s	n/a
Stroke volume index	≥35 mL/m <sup>2</sup>	N/a	<35 mL/m <sup>2</sup>

\* Key principle: Remember that EF does NOT equal cardiac output or cardiac index! Low flow states can be present regardless of EF



# 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

**BRIGHAM HEALTH**



**BRIGHAM AND  
WOMEN'S HOSPITAL**

*Thank You!*



**HARVARD MEDICAL SCHOOL  
TEACHING HOSPITAL**



[www.brighamandwomens.org/heart](http://www.brighamandwomens.org/heart)