Atrial Fibrillation and Atrial Flutter

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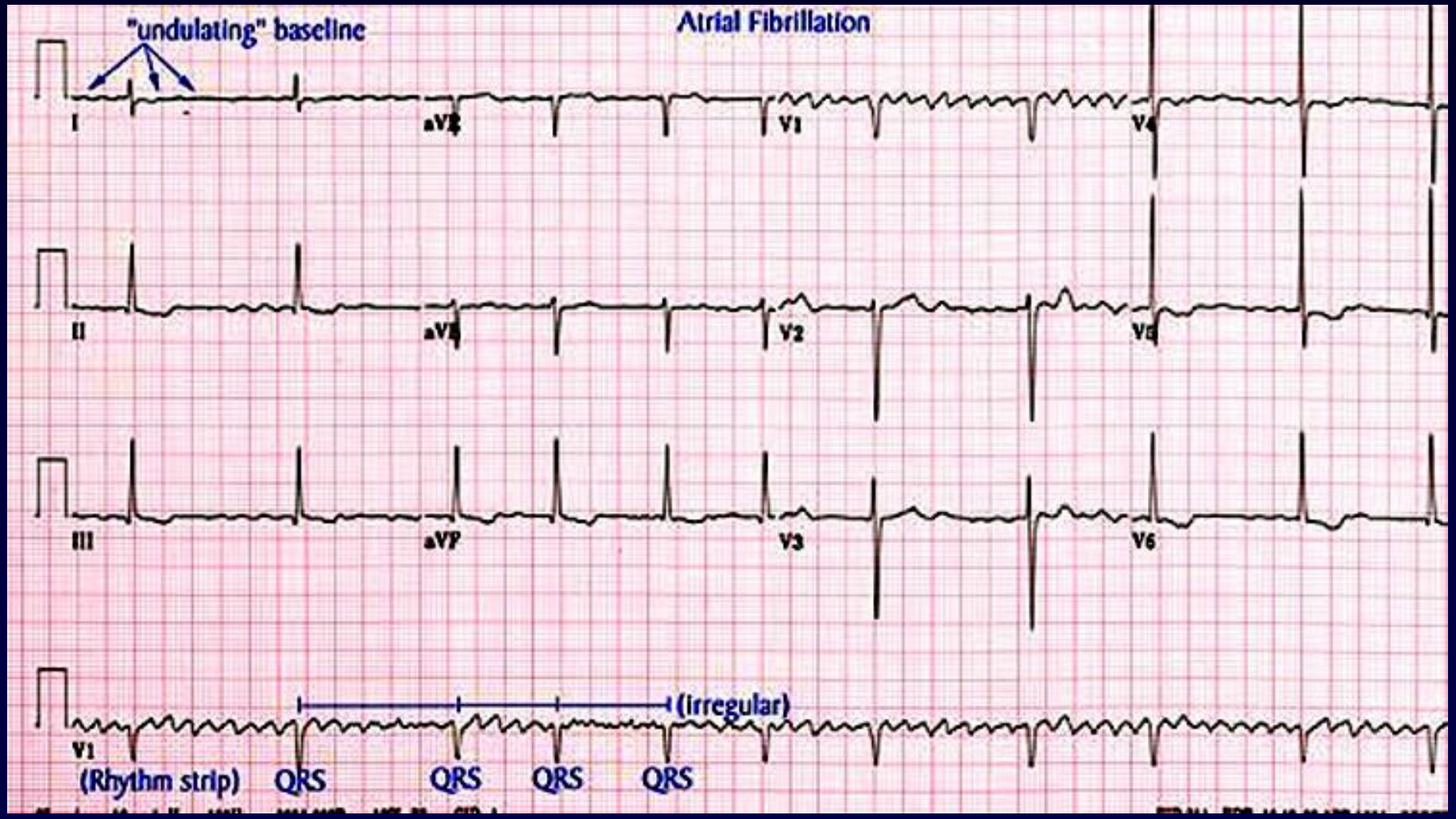
AF Introduction

Atrial Fibrillation

- Most common sustained arrhythmia
- Uncoordinated atrial electrical activation and contraction
- Atrial electrical activation rates exceed 350 bpm
- Associated with structural heart disease
- Main morbidity and mortality related to hemodynamic impairment and/or thromboembolism events

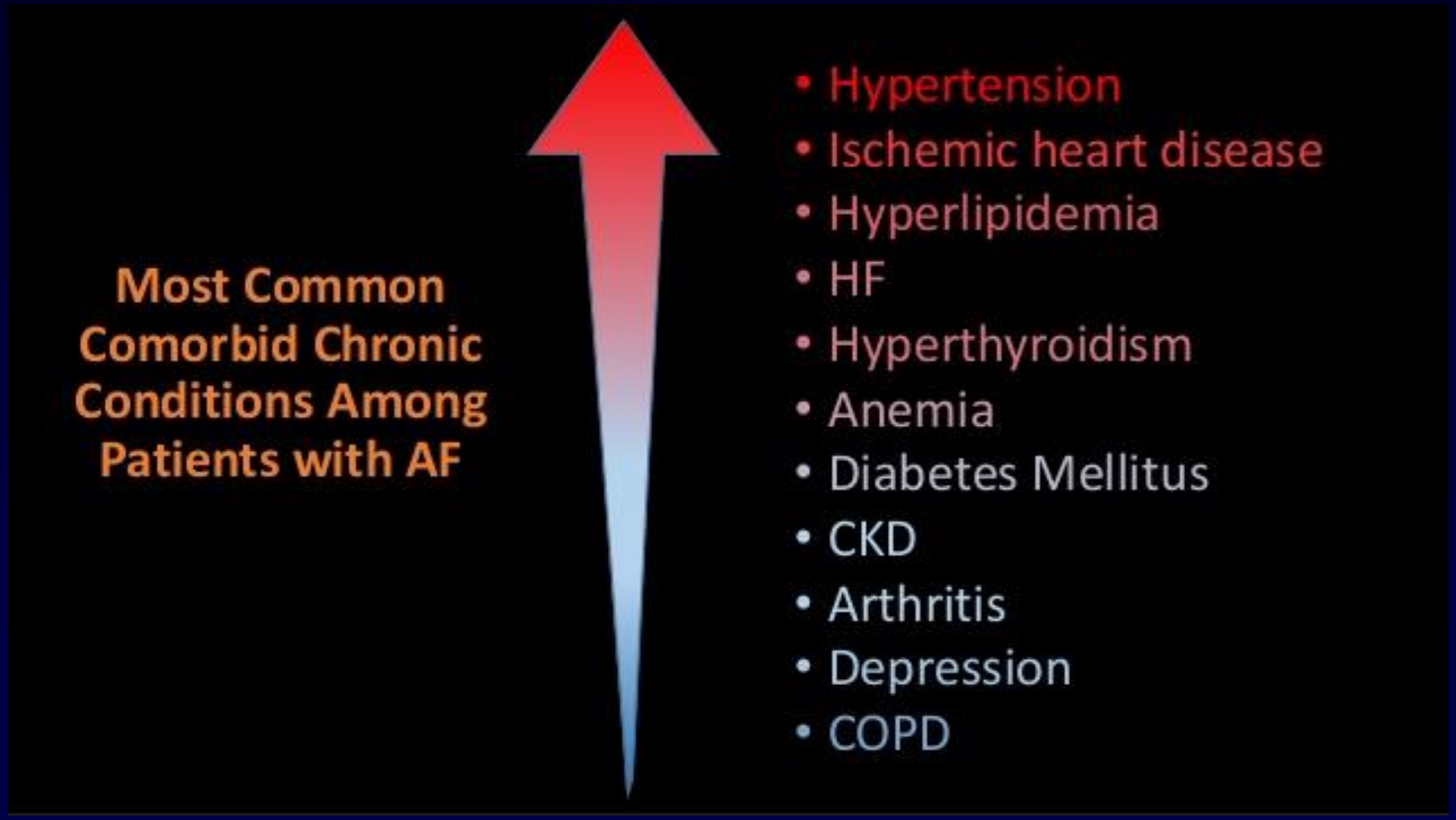
EKG


"undulating" baseline
Atrial Fibrillation
I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
V1
(Rhythm strip)
QRS
QRS
QRS
QRS
(irregular)

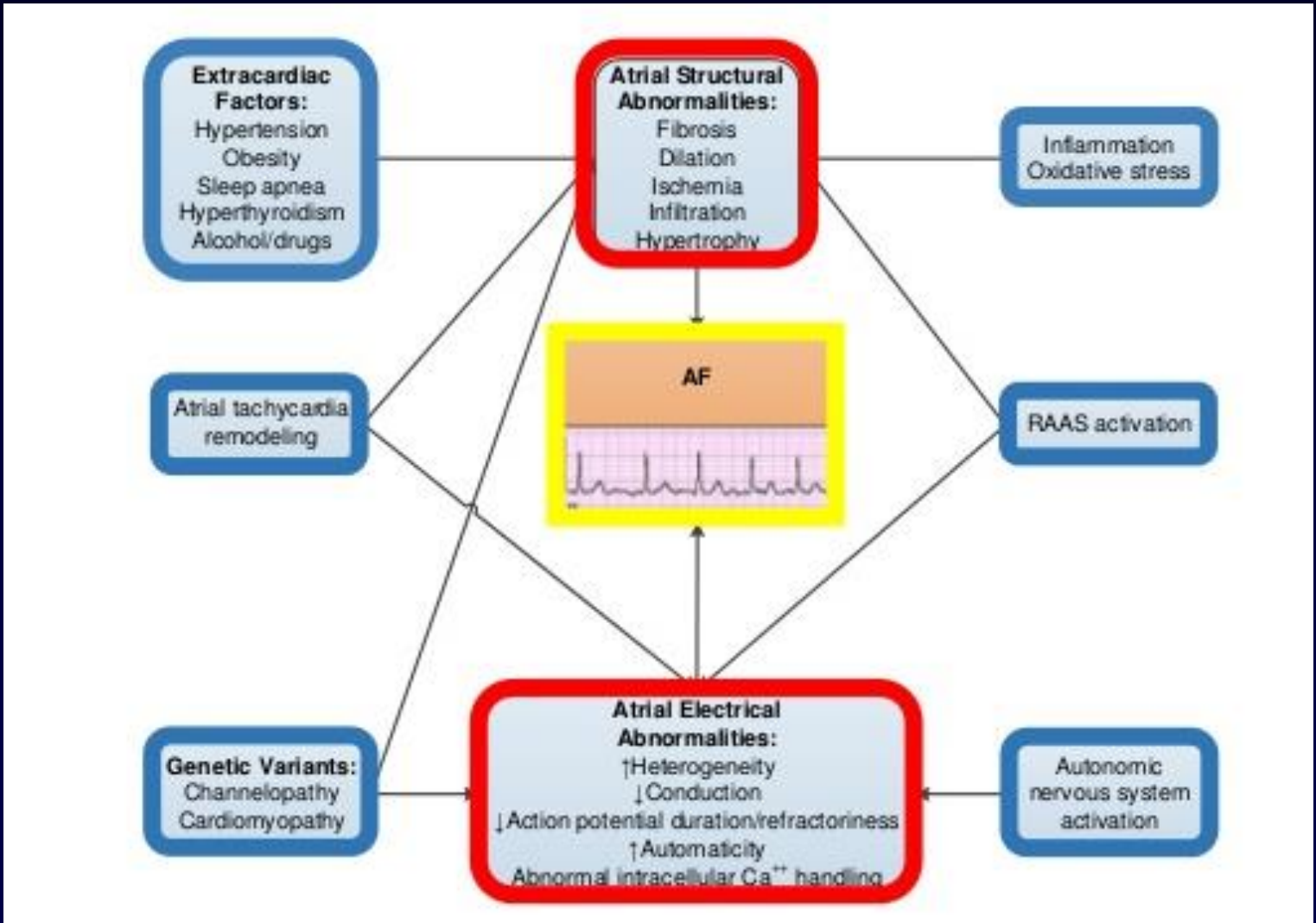
Epidemiology

- Incidence increases with age
- Overall prevalence greater among men
- Less common among black and Indo-Asian people
- 1:4 will develop AF after the age of 40
- First ever ischemic stroke: AF 15-25%
- New-onset AF 10% (AMI) and 20% (HF)

Risk Factors



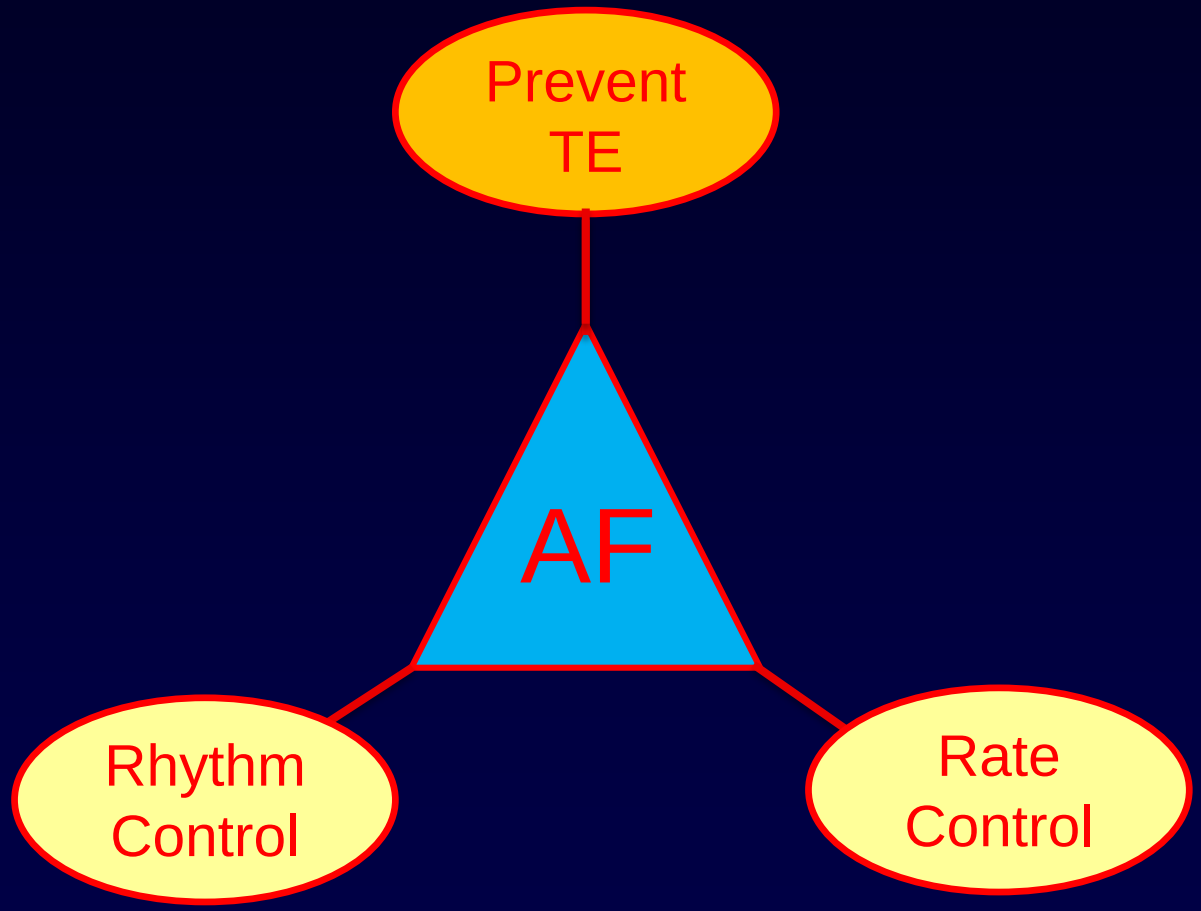
Pathophysiology



Classification

Term	Definition
Paroxysmal AF	• AF that terminates spontaneously or with intervention within 7 d of onset. • Episodes may recur with variable frequency.
Persistent AF	• Continuous AF that is sustained >7 d.
Long-standing persistent AF	• Continuous AF >12 mo in duration.
Permanent AF	• The term "permanent AF" is used when the patient and clinician make a joint decision to stop further attempts to restore and/or maintain sinus rhythm. • Acceptance of AF represents a therapeutic attitude on the part of the patient and clinician rather than an inherent pathophysiological attribute of AF. • Acceptance of AF may change as symptoms, efficacy of therapeutic interventions, and patient and clinician preferences evolve.
Nonvalvular AF	• AF in the absence of rheumatic mitral stenosis, a mechanical or bioprosthetic heart valve, or mitral valve repair.

Management Objectives



Stroke Risk Factors in AF

High Risk

- Mitral stenosis
- Prosthetic Heart Valves
- History of CVA/TIA

Moderate Risk

- Age >75
- HTN
- DM
- HF

Less Risk

- Age 65-75 years
- CAD
- Female
- Thyrotoxicosis

Stroke Risk Stratified in Non-Valvular AF

Definition and Scores for $CHADS_2$ and CHA_2DS_2-VASc	Score
$CHADS_2$	
Congestive HF	1
Hypertension	1
Age ≥75 y	1
Diabetes mellitus	1
Stroke/TIA/TE	2
Maximum score	6
CHA_2DS_2-VASc	
Congestive HF	1
Hypertension	1
Age ≥75 y	2
Diabetes mellitus	1
Stroke/TIA/TE	2
Vascular disease (prior MI, PAD, or aortic plaque)	1
Age 65–74 y	1
Sex category (i.e., female sex)	1
Maximum score	9

Annual Stroke Risk

CHA_2DS_2-VASc Score	Stroke Risk %	
0	0	
1	1.3	
2	2.2	
3	3.2	
4	4.0	
5	6.7	
6	9.8	
7	9.6	
8	12.5	
9	15.2	

CHA_2DS_2-VASc Score

- Score 0: Low risk, no anticoagulation needed
- Score 1: Low-moderate risk, consider anticoagulation (ASA)
- Score ≥2: Moderate-high risk, anticoagulation

- Warfarin versus NOAC (novel oral anticoagulant)

Issues with Coumadin

- Delayed onset/offset
- Unpredictable dose response
- Narrow therapeutic window
- Drug-drug, drug-food interactions
- Need for monitoring
- Higher bleeding rate
- Slow reversibility

Coumadin

- Monitoring of INR: weekly during initiation, then monthly
- Bridging can be done as an outpatient
- Bridging prior to procedure/surgery if mechanical MV or Bjork-Shiley AV
- Medication interactions, i.e. Amiodarone, ABX, antifungals

NOAC: Novel Oral Anticoagulant

Renal Function	Warfarin	Dabigatran† (Pradaxa)	Rivaroxaban† (Xarelto)	Apixaban† (Eliquis)
Normal/mild impairment	Dose adjusted for INR 2.0–3.0	150 mg BID (CrCl >30 mL/min)	20 mg QD with the evening meal (CrCl >50 mL/min)	5.0 or 2.5 mg BID‡
Moderate impairment	Dose adjusted for INR 2.0–3.0	150 mg BID (CrCl >30 mL/min)	15 mg QD with the evening meal (CrCl 30–50 mL/min)	5.0 or 2.5 mg BID‡
Severe impairment	Dose adjusted for INR 2.0–3.0 §	75 mg BID ‖ (CrCl 15–30 mL/min)	15 mg QD with the evening meal (CrCl 15–30 mL/min)	No recommendation¶
End-stage CKD not on dialysis	Dose adjusted for INR 2.0–3.0 §	Not recommended¶ (CrCl <15 mL/min)	Not recommended¶ (CrCl <15 mL/min)	No recommendation¶
End-stage CKD on dialysis	Dose adjusted for INR 2.0–3.0 §	Not recommended¶ (CrCl <15 mL/min)	Not recommended¶ (CrCl <15 mL/min)	No recommendation¶#

NOAC

- Edoxaban
  - Relatively newer
  - Hepatic clearance
  - Contraindicated CrCl >95 (increased ischemic CVA)
- Pradaxa
  - Reversal agent: Idarucizumab (Praxbind) - IV injection 5g
- Xarelto/Eliquis
  - Reversal agent: Andexxa – IV bolus 400 mg + 4mg/min 2 hrs

NOAC vs Warfarin

Features	Warfarin	NOAC
Onset	Slow	Rapid
Dosing	Variable	Fixed
Food effect	Yes	No
Drug interactions	Many	Few
Monitoring	Yes	No
Half-life	Long	Short
Antidote	Yes	No

HAS-BLED Score

Risk Factors	Points
Hypertension (> 160 mm Hg systolic)	1
Abnormal renal or hepatic function	1-2
Stroke	1
Bleeding history or anemia	1
Labile INR (TTR < 60%)	1
Elderly (age > 75 years)	1
Drugs (antiplatelet, NSAID)	1-2
High risk (> 4%/year) Moderate risk (2-4%/year) Low risk (< 2%/year)	≥ 4 2-3 0-1

- 1 year risk of IC bleed, hospitalization, Hb decrease >2, transfusion

Non-compliant Patient

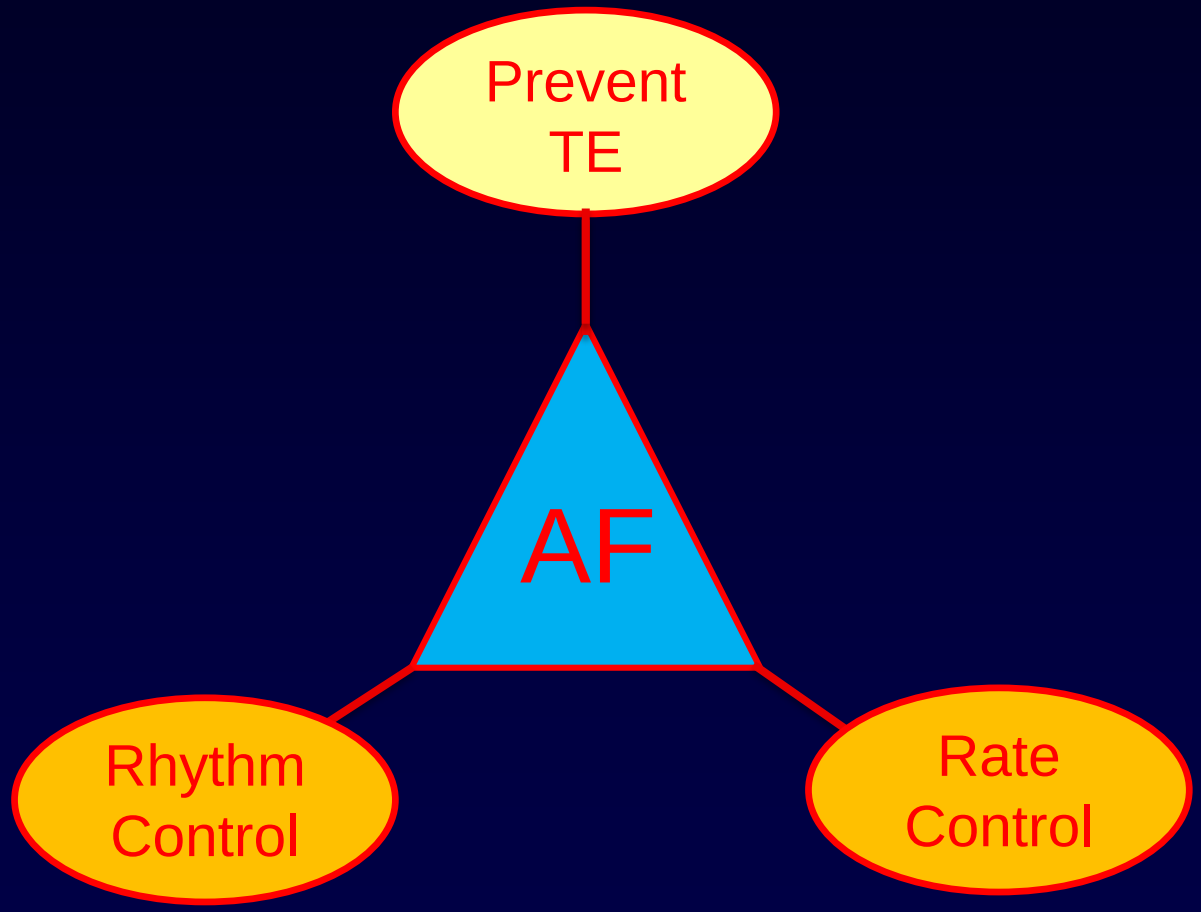
- Issue Dependent
  - Missing clinic follow-up but takes medications every day: NOAC
  - Missing doses frequently but attends clinic without fail: Coumadin

Valvular AF Anticoagulation (RHD/Mitral Stenosis/Prosthesis)

- Anticoagulation: ALWAYS Coumadin
- Prosthetic valves: use the valve INR goals
  - MV: INR 2.5-3.5
  - AV: INR 2-3
  - AV Exceptions (Starr-Edwards or tilting disc valves): INR 2.5-3.5

- Side Note: Mechanical valves routinely require ASA with Coumadin

Management Objectives



Rate vs Rhythm Control

They are always equal right???

?

?

?

?

NO!

AFFIRM!

RACE!

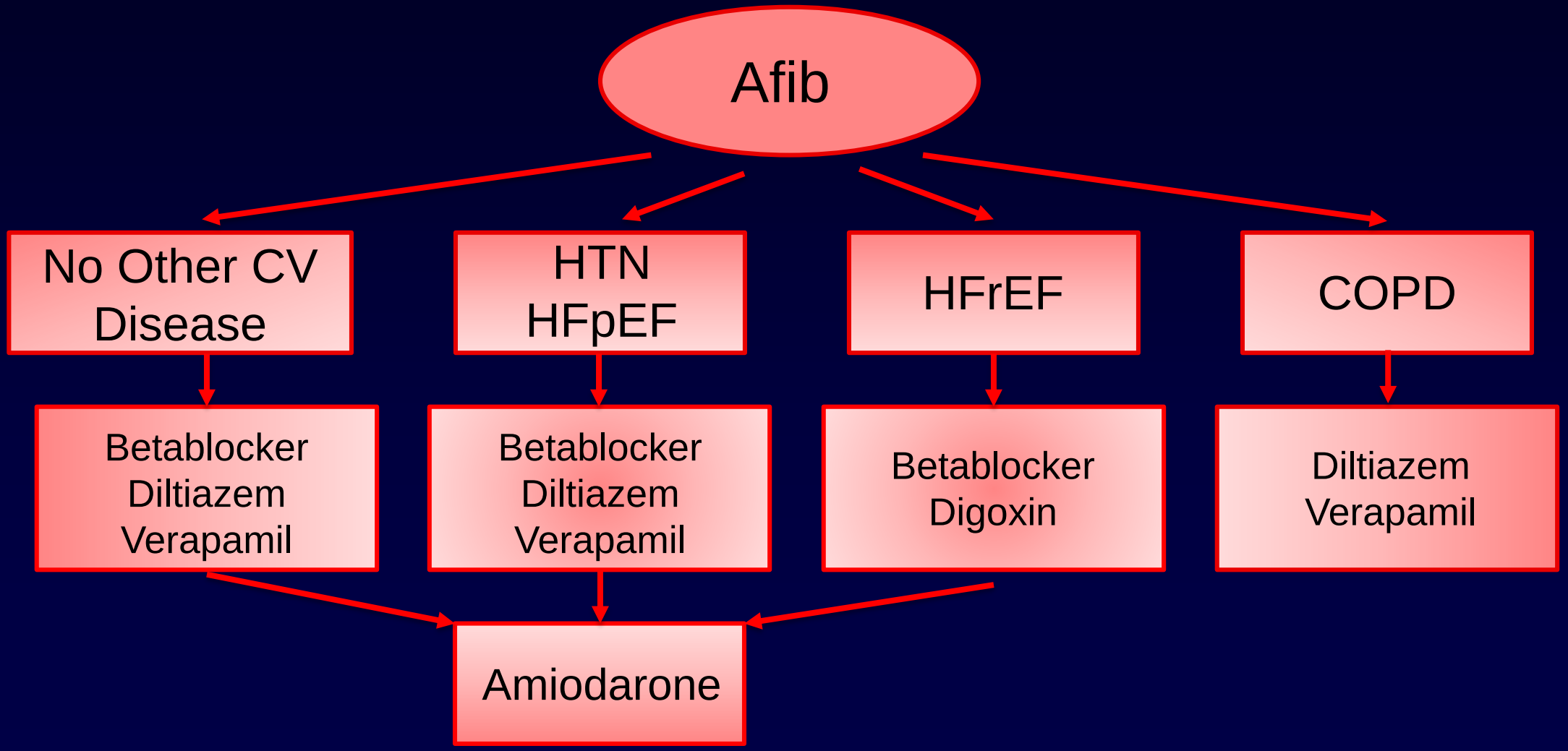
Rate vs Rhythm Control

- AFFIRM
  - Mostly older patients, average age of 75-80
  - >75%, primary cause of Afib was HTN/CAD
  - 15% had previously failed anti-arrhythmics
  - High cross over to rate control ≈ 25-30%
  - Selection bias against sicker patients
  - Equivalence was not very robust with HF sub group

Rate Control vs Rhythm Control

Favor Rate Control	Favor Rhythm Control
Persistent AF	Paroxysmal AF or newly detected AF
Less symptomatic	More symptomatic
Age ≥ 65 years	Age < 65 years
HTN	No HTN
Previous failure of antiarrythmic drug	No prior attempt with antiarrythmic drug

Drug Therapy for Rate Control



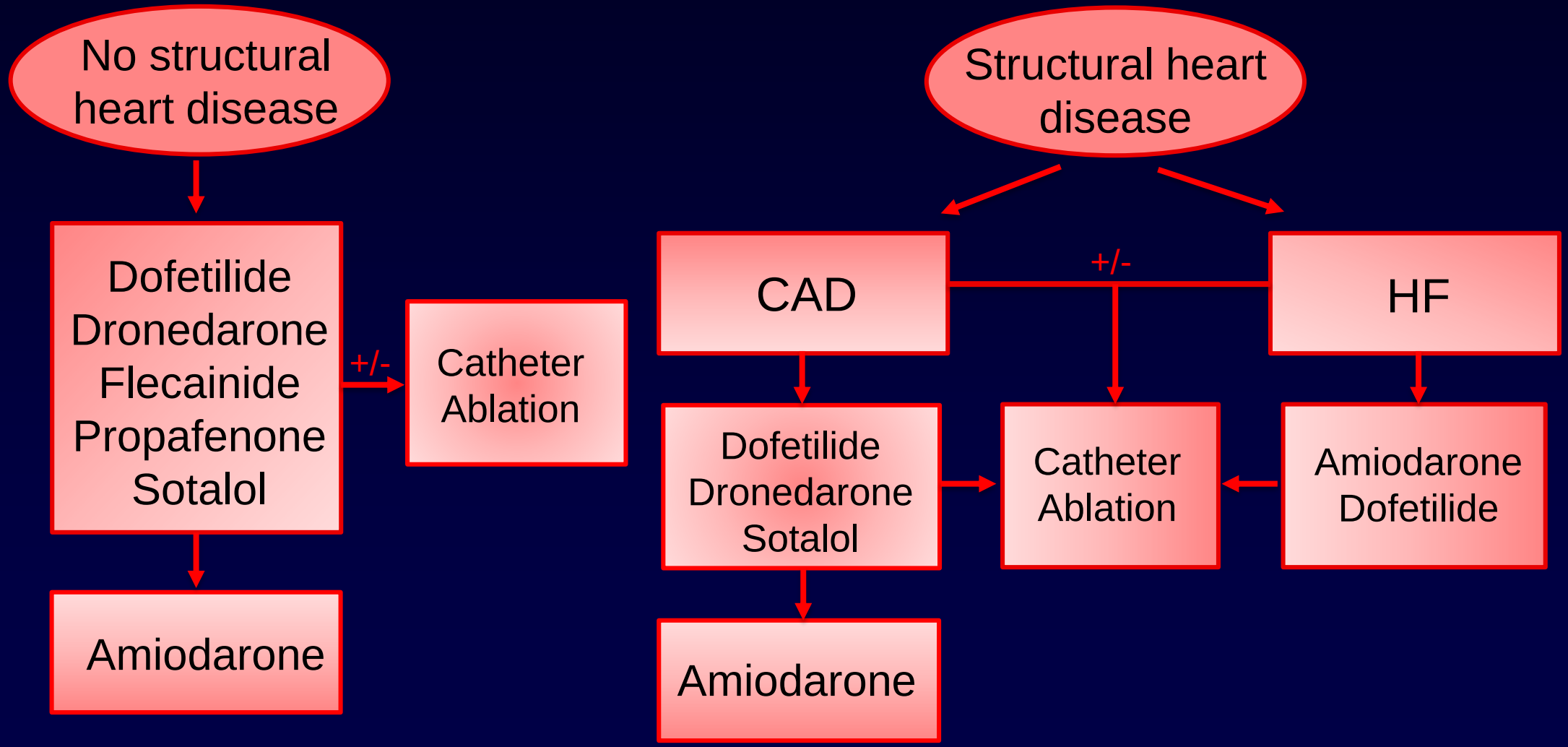
Target Heart Rate for Rate Control

- AFFIRM 2
  - Lenient rate control: HR <110 at rest
  - Strict rate control: HR <80 at rest
  - Permanent AF at least 1 year, age <80

Results: Lenient rate control is non-inferior to strict rate control.

Goal HR at rest: <110 IF well tolerated

Drug Therapy for Rhythm Control



Rhythm Control Considerations

Anticoagulation (AC) / TEE prior to Cardioversion (CV)

- Issue:
  - Risk of atrial/appendage thrombus causing embolism during CV
  - Post CV atrial stunning
- Early CV:
  - AF/Flutter < 48 hours: AC with heparin/LMWH just prior to CV
  - AF/Flutter > 48 hours: AC and TEE followed by CV
- Delayed CV:
  - AF/Flutter: AC for 4 weeks, may consider TEE prior to CV
- Post-CV AC:
  - Minimum short term AC: 1 month after CV
  - Long term AC as appropriate based upon risk profile

AF Special Considerations

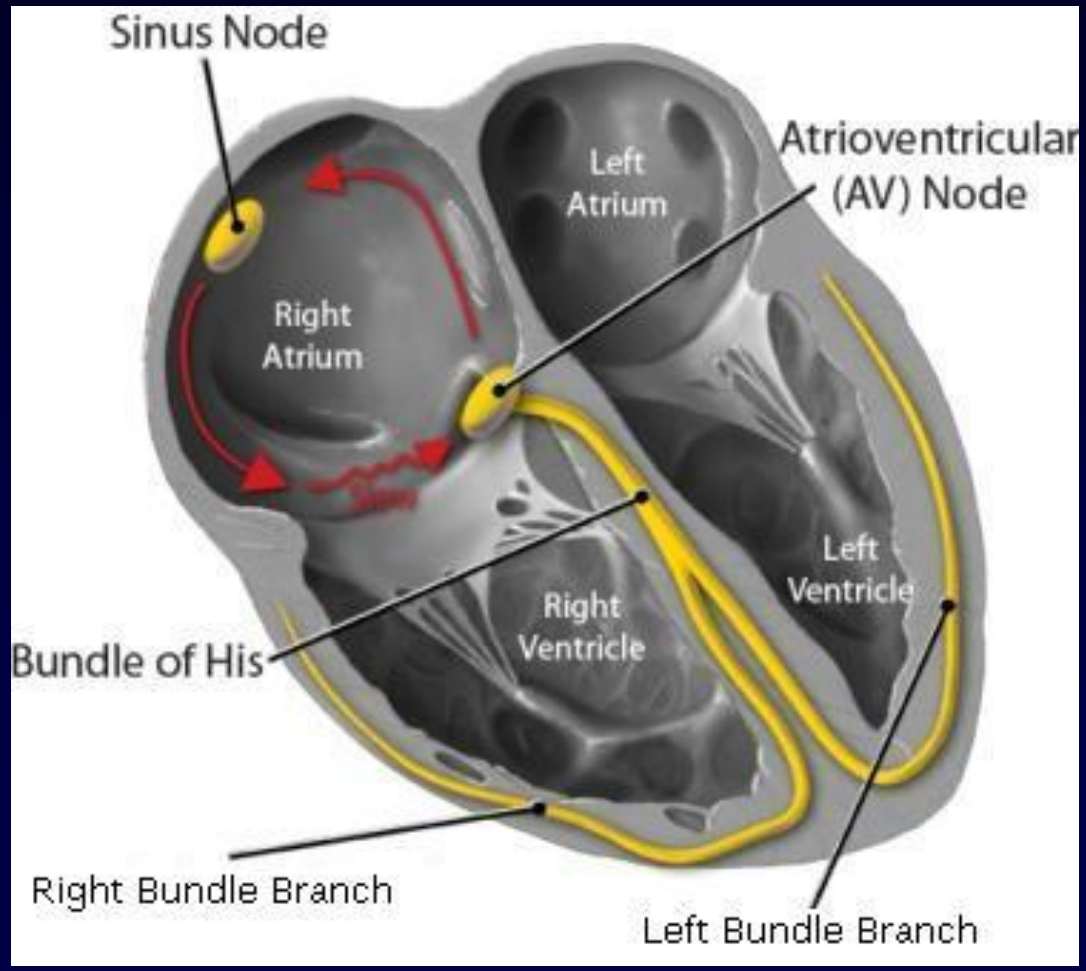
- Please check a TSH!!!
- AF with HCM: chronic AC is needed regardless of risk profile
- AF with Rheumatic Mitral Stenosis: goal HR 60-80
- AF with pre-excitation (WPW):
  - Unstable:
    - DCCV
  - Stable:
    - Avoid AVN Blocking agents: adenosine, CCB, BB
    - Avoid digoxin or amiodarone
    - Use procainamide or ibutilide

Atrial Flutter Introduction

Atrial Flutter

- Supraventricular tachycardia caused by a MACRO-reentry circuit, typically in the right atrium
- Atrial rate predictably around 300 (can vary 200-400)
- Ventricular conduction is dependent on AVN block
  - 1:1 (300), 2:1 (150), 3:1 (100), 4:1 (75), or variable block
- Flutter at 1:1 is rare (pre-excitation/WPW, sympathetic overdrive -> V Fib

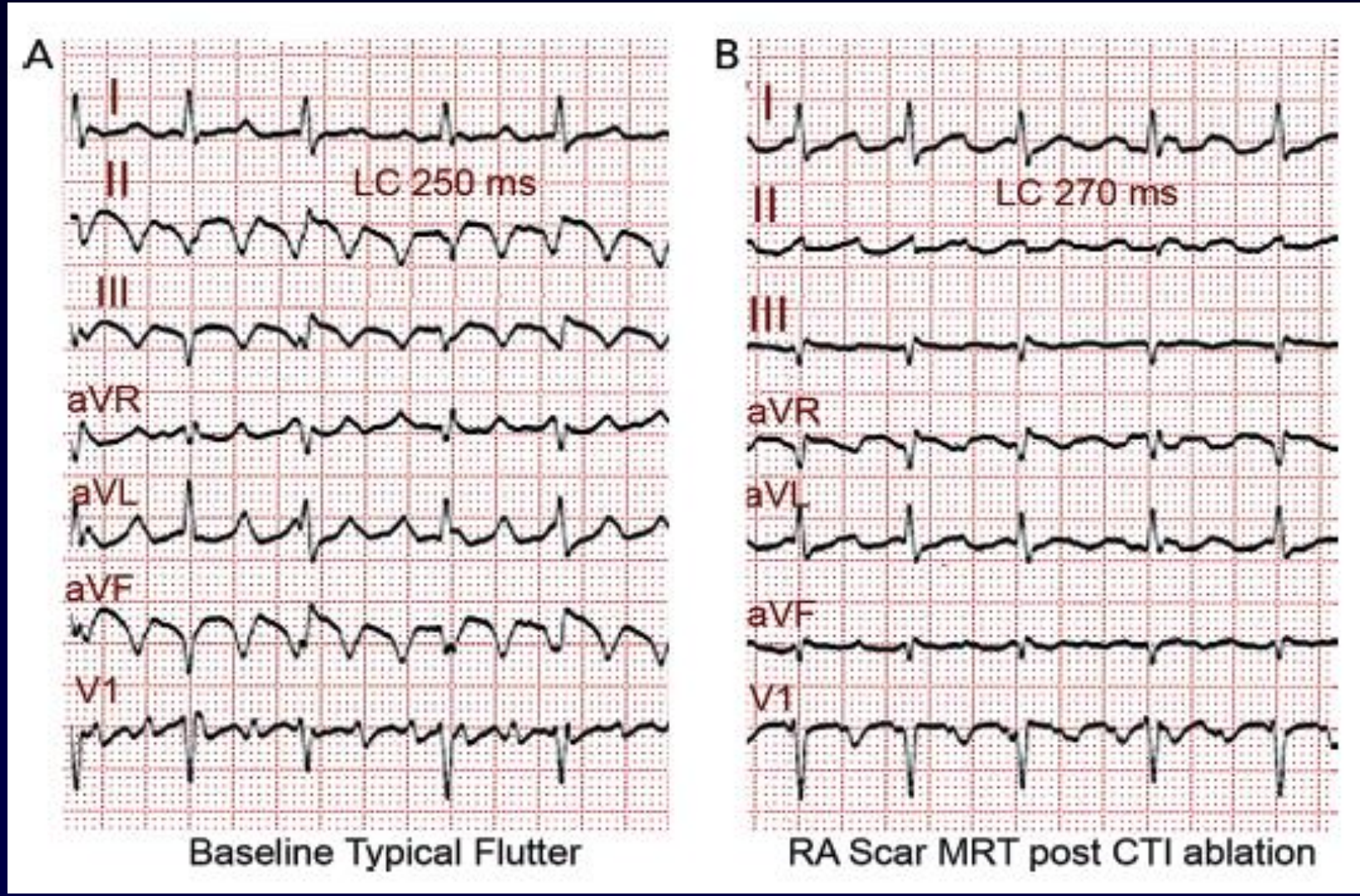
Atrial Flutter Introduction



Atrial Flutter Introduction

- Typical (Common) Atrial Flutter (90%)
  - Counterclockwise reentry circuit
  - Inverted flutter waves in inferior leads II, III, aVF
  - Positive flutter waves in V1
  - High success rate of RF ablation >95%
- Atypical (Uncommon) Atrial Flutter (10%)
  - Clockwise reentry circuit
  - Positive flutter waves in inferior leads II, III, aVF
  - Inverted flutter waves in V1

Atrial Flutter Introduction



Atrial Flutter AC and Rate/Rhythm control

- AF algorithms apply equally to Atrial Flutter
  - Anticoagulation
  - Rate control
  - Rhythm control
- Caveats
  - Typical Atrial Flutter should ideally be referred for early RF ablation
  - Rate control agents have a non-linear effect on degree of AVN block and therefore effect on ventricular rate.

Case #1

- 68 year old male presents with palpitations and progressive shortness of breath for one week. He has a history of DM, CAD, and HFrEF. His last EF 30%. He has a history of normal renal function. He is taking Coreg 6.25 BID, Lisinopril 10 daily, Aldactone 12.5 daily, Lipitor 40 daily, and ASA 81 daily.

- In the ER he has an initial BP of 95/60 and an irregular pulse of 125. EKG confirms AF. The initial treatment strategy pursued is rate control.

- A. Diltiazem 20 mg IV
- B. Metoprolol 25 mg PO
- C. Metoprolol 5 mg IV

Case #1

- Diltiazem 20 mg IV is given
- After 10 minutes, the patient's heart rate improves to 115 bpm. He reports being less anxious and feeling better. After 20 minutes his heart rate is noted to increase to 145 bpm. He reports feeling dizzy. A repeat BP is noted to be 65/40 mmHg.
- Next Step??
- DCCV – the patient is noted to be in NSR with a BP of 120/85 and feeling better
- What happened??
- Learning Point: AVOID non-dihydro CCB for rate control in HF patients
- Alternative rate control agents??
  - Digoxin and BB ; Amiodarone (if started on AC)

Case #2

- 60 year old female presents complaining of waking up with palpitations early the same morning. She has been having these episodes multiple times during the past week including during the daytime. On further questioning she states she had palpitations several years ago which resolved after cessation of caffeine intake and control of her BP. EKG now demonstrates Afib at a rate of 105. She is placed on telemetry and noted to be back in NSR at a rate of 67. Her physical exam is benign. She takes HCTZ 25 daily and Norvasc 5 daily. She asks what can she do?

- What testing do you want and why??

- Anticoagulation Plan??

- Rate vs rhythm plan??

Case #3

- 55 year old male presents to clinic complaining of a racing heart rate on and off over the past 3 months. He lives alone and reports no prior medical conditions. His BP is noted to be 155/95. His BMI is 48. Exam is otherwise unremarkable. EKG demonstrates NSR with a rate of 72 bpm.
- His insurance allows you to order only 2 further diagnostic tests…
- Ziopatch (14 day outpatient cardiac monitoring) is ordered and demonstrate AF 16% of the time with the longest period being 5 minutes.
- Sleep study is ordered and demonstrates Obstructive Sleep Apnea.
- What is your treatment plan???

Case #4

- 65 year old male presents to ER with recurrent racing heart. He has a history of moderate LVH and mild LV dysfunction. Telemetry and EKG are consistent with AF and rapid ventricular rate of 170 bpm. BP is 170/105. His exam is otherwise unremarkable. He is treated by the ER initially with IV Metoprolol. There is only mild heart rate control.

- His dosing is increased to an oral regimen of Metoprolol 100 Q6H. However, his ventricular rate is improved yet remains >130 bpm. A heparin gtt is started and an IV digoxin load is initiated for better rate control. He is admitted to the ICU.

- In the ICU, his rates remain 120-130. He is asymptomatic. Cardiology is consulted and states they are planning a TEE with DCCV Monday morning. It is now Friday afternoon.

- Overnight, the rates remain 120-130 still. Oral diltiazem is started and increased eventually to 90 mg PO Q6H with great rate control. His BP is now 110/65 and HR is 80-95 bpm.

- The ICU team rounds Sat morning and decides Monday is >48 hours away. They wish to utilize hospital resources efficiently. They start a new medication requiring an initial intravenous loading regimen. Two hours later a code blue is called…..WHAT HAPPENED??