

### Atrial Fibrillation

- It is a supraventricular tachyarrhythmia
- The most common arrhythmia seen in clinical practice
- Almost 5% of the population older than 70+ years
- The prevalence of AF increases dramatically with age
- AF is associated with a 1.5- to 1.9-fold ↑ risk of death
- It's characterized by disorganized atrial electrical activity
- Progressive deterioration of atrial electromechanical function with several theories of abnormal activity

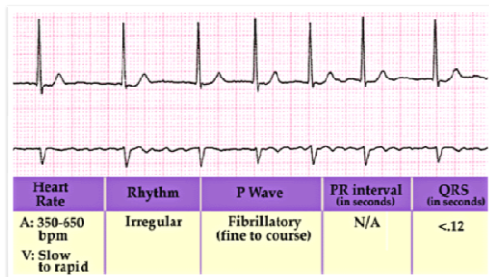
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### ECG of Atrial Fibrillation

- Absence of P waves – see leads LII, LIII, aVF and V1
- Rapid oscillations (or fibrillary *ff*) waves
- Low amplitude wavelets or mostly flat base line
- These vary in amplitude, frequency, and shape
- AF has an typically irregular ventricular response
- Irregularly irregular heart and pulse
- Narrow QRS usually, reentrant pathway wide QRS

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### ECG of Atrial Fibrillation



### Pathophysiology of AF

- Initiating event and permissive atrial substrate
- Multiple mechanisms may be present
- Focal pulmonary vein triggers – enlarged RA or LA
- Multiple wavelets, mother waves, daughter wavelets
- Fixed or moving rotors & macro-reentrant circuits
- Automatic foci in atria
- Catecholamine excess, hemodynamic stress, atrial ischemia, atrial inflammation, metabolic stress

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### Symptoms of AF

- AF present with a wide array of symptoms
- Majority are asymptomatic
  - Palpitations, dyspnea, fatigue, dizziness, angina
  - Decompensate heart failure, Polyuria (↑ BNP)
- In addition, AF can be associated with
- Hemodynamic dysfunction, CHF
  - Tachycardia-induced cardiomyopathy
  - Systemic Thromboembolism

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### Clinical Signs of AF

- Irregularly irregular heart beat – pulse-apex disparate
- May or may not have tachycardia – depends on AVN
- Variable intensity of 1<sup>st</sup> heart sound
- Occasional S3; But S4 is absent in all,
- Absence of ‘a’ waves in Jugular Venous Pulse (JVP)
- Signs of underlying heart disease, RHD, CAD, HCM, DCM
- Look for Cardiac Failure and Atrial Embolization
- May have WPW associated – Ventricular rate > 200
- Normally narrow QRS tachycardia, may be wide QRS

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## Causes of Atrial Fibrillation

Rheumatic Valvular Heart Disease (RVHD)

Diabetes, Hypertension, CAD, LV Dysfunction

Male Gender, Advancing Age, Hyperthyroidism

Congenital or Structural Heart Disease, LA, RA

Cardiomyopathy, Alcohol use, Illicit Drugs

Acute pulmonary problems, Cardiac Surgery

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## Atrial Fibrillation

- AF with structural heart disease (RVHD, HT Heart, Cardiomyopathy, Congenital Heart Disease, CAD)
- Elevated BNP suggests underlying heart disease
- AF without concomitant structural heart disease
- "Lone Atrial Fibrillation" – AF in younger patients without structural heart disease with lower risk of TE
- Hemodynamic instability – severe dyspnea, reduced O<sub>2</sub> saturation, fall of BP, severe chest pain, shock etc.

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## Investigations

- 12 Lead ECG with rhythm strip
  - Look for pre excitation, Determine Heart Rate
  - Evaluate for LVH, LBBB, Previous MI
  - QT-QRS intervals for pts on anti arrhythmic drugs
- Six-minute walk test or exercise test (rate control)
- Holter monitoring; Electrophysiology only in selected cases
- Echocardiography (TTE), TEE (to study the atria)
- Chest X-Ray to evaluate pulmonary disease
- Thyroid function, Renal Function, Serum Electrolytes

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## Types of Atrial Fibrillation

- Paroxysmal AF: if it terminates spontaneously in fewer than 7 days (often in <24 h).
- Persistent AF: when it terminates either spontaneously after 7 days or following cardio version.
- Permanent AF: It persists for more than one year, either because cardio version has failed or because cardio version has not been attempted

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## First Episode of Atrial Fibrillation

- Is it primary or secondary – A thorough evaluation is a must
- Structural heart disease and age are most important factors
- AF without structural heart disease is "Lone Atrial Fibrillation"
- MVD, AVD, HT, CAD, LVD, DCM, HCM, PE, ASD, ↑ Thyroid fun
- Coffee, Tobacco, Ethanol, Stress, Fatigue – may trigger AF
- No organic HD, No WPW – Address the precipitating factors
- Observe for recurrence of AF
- If HD is underlying – AC, Rate control, Rhythm control needed.

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## Paroxysmal Atrial Fibrillation

- If no underlying HD – Rest, Sedation, Digitalis for the attack
- Hemodynamic compromise – immediate cardioversion
- Hemodynamically stable – Rate control, AC & Rhythm control
- Beat Blockers, CCB, Flecainide, Propafenone – IV may be given
- No structural Heart Disease - Flecainide, Propafenone preferred
- Amiodarone is in patients with HF, DCM, structural HD
- Sotalol in CAD and HT without LVH
- Catheter ablation and MAZE procedure in refractory cases

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### Chronic Atrial Fibrillation

- Ventricular rate control and Anticoagulation are the best
- Cardioversion needed only if hemodynamic benefit is seen
- Either pharmacological or DC cardioversion can be tried
- Usually no more than one attempt of DC cardioversion
- Reverting to sinus rhythm didn't give extra benefit (AFFIRM)
- Long term anticoagulation is a must – risk benefit titration
- Catheter ablation to HIS bundle with pace maker implant
- Only if refractory as it makes the pt pace maker dependent

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### Anticoagulation

- Atrial fibrillation is a powerful risk factor for stroke
- The most important treatment in AF is anticoagulation
- Acute cardio version is risky without anticoagulation
- This risk is same for electrical or pharmacologic CV
- TE risk increases if AF is of > 48 hours
- Effective Anticoagulation reduces the risk by three fold
- Initiation of AC can be done with Heparin or LMWH
- Oral direct thrombin inhibitor (Ximelagatran) no INR

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### Risk Factors for Stroke in AF

Male Gender, Advancing Age

Rheumatic Valvular Heart Disease (RVHD)

Diabetes, Hypertension, CAD, LV Dysfunction

Heart Failure; Prior history of TIA/Stroke

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### CHADS<sub>2</sub> Scoring

One Point

• Cardiac Failure

One Point

• Hypertension

One Point

• Age more than 75

One Point

• Diabetes

Two Points

• Stroke or TIA, STE

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### CHADS<sub>2</sub> based Stroke Incidence

CHADS <sub>2</sub> Score (points)	Adjusted Stroke Incidence % per year
0	1.9
1	2.8
2	4.0
3	5.9
4	8.5
5	12.5
6	18.2
Non valvular Atrial Fibrillation Rx with anticoagulation	

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### Risk Stratification

Risk Factor Stratification	Risk Factors to be Ascertained
High Risk Factors	Prior Stroke/TIA or STE Event
Moderate Risk Factors	Age >75, HF, HT, EF <35%, DM
Other Risk Factors	Female, CAD, ↑ Thyroid, < 75
Non valvular Atrial Fibrillation Rx with anticoagulation	

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### Rx. Recommendations

Risk Category	Recommended Treatment
Age < 65; No RF	Aspirin 325 mg/day
Age 65-75, DM, CAD	1 RF – Give Aspirin 325 2 RF – Warfarin (INR 2.0 to 3.0)
Age > 75, HT, LVD,MVD, Pr HV, Stroke, TIA, PE or More than 2 Moderate RF	Warfarin (INR 2.5 to 3.5)
Atrial Fibrillation Treatment with Anticoagulation	

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### Prevention of Thromboembolism

- AF is associated with risk of ↓ TE – Stroke, TIA, Perph E
- Anticoagulation with Heparin and Warfarin to ↓ TE
- Anticoagulation – risk of fatal bleeding – monitor INR
- Anti platelet Rx with Aspirin, Clopidogrel to ↓ TE
- Use the CHADS<sub>2</sub> score to stratify the patients
- CHADS<sub>2</sub> Score of zero need only Aspirin or Clopidogrel
- CHADS<sub>2</sub> score of 3 or above need Warfarin / Heparin
- Score of 1 or 2, see H/o stroke, TIA, CAD, HT, Females

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### Rate Control

- Control of ventricular rate is a critical a component
- Rate-controlling agents act by ↑ AV nodal refractoriness
- β blockers and CCBs are first-line rate control agents
- Given either I.V. or orally depending on the need
- ROAD patients we need to exert caution with βBs
- HR < 80 at rest; < 110 with exertion (6 min walk test, TMT)
- Digoxin is rarely used as monotherapy
- Some what useful in pts with HF and LV dysfunction
- Amiodarone - Class II a recommendation for rate control

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### Rate Control

- For rapid rate control I.V. drug should be used
- IV CCBs (DLZ, VPM), β Blocker (Metoprolol, Esmolol)
- Diltiazem is preferred because of least side effects
- For pts with ↑ sympathetic tone – Esmolol is preferred
- AF with heart failure; Digoxin is the choice; Not a CCB, BB
- Digoxin has delayed onset of action; Not effective rapidly
- Amiodarone is the choice in AF with CHF and ↓ BP
- Flecainide or Amiodarone in AF with pre excitation
- CCB and digoxin are contraindicated in pre excitation

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### Rhythm Control

- Rate and Rhythm control yield similar results (AFFIRM)
- Young pts who remain symptomatic after rate control
- In whom rate control drugs are contraindicated
- Who do not tolerate rate control drugs
- Rate and Rhythm control drug combination cab be used
- Class I c (Flecainide, Propafenone) are contraindicated in CAD
- In CAD and Diastolic Heart Failure – Amiodarone is the choice

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### Rhythm Control

- Sinus Rhythm requires Rx of CV Risk factors, ↑ Thyroid
- Anti arrhythmic drugs restore Sinus Rhythm
- Amiodarone is safe and effective to restore SR
- Its adverse effects may be a problem in some
- Sotalol is efficacious for maintenance of sinus rhythm
- Requires monitoring of the QT interval & electrolytes
- It is contraindicated in pts with structural heart disease
- Catheter ablation is an alternative to drug therapy in symptomatic pts without structural heart disease

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AADs in AF					
AA Drug	Class	Dosage	Indication	Remarks	CI / SP
Amiodarone	III	200-400 OD	Structural HD, HF	Other ADR	Brady, Sparf
Dofetilide	III	125-250 µg BD	Structural HD, HF	Non pediatric	CKD, QT ↑
Sotalol	III	80-160 BID	No Structural HD	Maintenance	QT ↑, TdP
Flecainide	I c	50-150 BID	No Structural HD	PIP- Lone AF	CAD, BB
Propafenone	I c	150-300 OD	No Structural HD	PIP- young pts	CAD, BB
Dronedaronone	All	400 mg BID	No Structural HD	Heart Failure	QT ↑, Brady

AFFIRM, CAST, CTAF, SAFE-T, RACE

- ### Cardioversion
- Elective cardioversion and emergency cardioversion
  - Electrical and chemical cardioversion (Ibutilide IV CIII)
  - Most successful when initiated within 7 days of onset
  - Acute cardioversion in hemodynamically unstable
  - Pharmacological cardioversion no sedation or anesthesia
  - But, risk of ventricular tachycardia serious arrhythmia
  - Direct current (DC) energy cardiovertor is used
  - Maintain serum potassium in upper normal range

- ### Cardioversion
- Hemodynamically unstable AF
  - Severe dyspnea or chest pain with AF
  - Patients with pre-excitation in ECG with AF
  - Non responders of AF with rate control therapy
  - Pts without any valvular or functional heart abnormality
  - DC cardioversion - electrical current that is synchronized to the QRS complexes; monophasic or biphasic waves
  - The required energy for cardioversion is usually 100-200 J

- ### Long Term Management
- Reducing the chance of atrial fibrillation recurrence
  - Reducing atrial fibrillation-related symptoms
  - Control of ventricular rate, ↓ risk of STE and Stroke
  - Management of CV risk factors to reduce the AF recurrence and related morbidity and mortality
  - Anticoagulation is a must for all except 'lone AF'
  - Younger pts rhythm control, older ones rate control
  - AF begets AF, Sinus Rhythm begets Sinus Rhythm

- ### Surgical Therapy
- Atria are transected and resutured to ↓ the critical mass
  - Surgical MAZE procedure is an attractive procedure
  - Catheter Ablation is the widely used procedure
  - Compartmentalization with continuous ablation lines
  - Catheter ablation of focal triggers of atrial fibrillation
  - AV node ablation & insertion of a permanent pacemaker
  - Percutaneous closure of the left atrial appendage to ↓ TE
  - Post Ablation Anti Arrhythmic Drug therapy

- ### Take Home Points
- Atrial Fibrillation is the most common arrhythmia
  - Evaluate for any underlying structural heart disease
  - Classification patients and risk stratification for Rx
  - Thrombo embolism is the main threat in a pt of AF
  - Age is a very strong risk factor for AF as well as STE
  - Anticoagulation with Warfarin is the main stay of Rx.
  - Rate control with β-B and CCBs is a must in all
  - AAD for rhythm control only in selected chronic AF
  - Cardioversion, Catheter Ablation, MAZE in selected pts