Atrial Fibrillation Management in the Hospital Setting

Definition and Epidemiology

Atrial fibrillation (AF) is an irregular, rapid atrial rhythm causing ineffective atrial contraction, increasing thromboembolism risk, heart failure (HF), and mortality

This guide details inpatient AF management, including causes, diagnostic workup, rate/rhythm control, anticoagulation, cardioversion, ablation referral, and complications

Prevalence

AF affects ~10-15% of inpatients, with 30% new-onset due to surgery, infection, or MI

Incidence

Incidence rises with age (5% at 65, 10% at 80); 20-30% of HF admissions involve AF

Risk Factors

Hypertension (HTN), HF, coronary artery disease (CAD), diabetes, obesity, alcohol, thyroid disease, OSA

Rare Demographics

Pediatric AF (e.g., congenital heart disease), paroxysmal AF in athletes, post-transplant AF

Pathophysiology

Mechanisms

- AF results from atrial electrical remodeling (shortened refractory period) and structural changes (fibrosis, dilation), triggered by inflammation, autonomic imbalance, or stretch
- Re-entrant circuits and ectopic foci in pulmonary veins sustain chaotic atrial activity

- Loss of atrial kick reduces cardiac output by 20-30%, increasing HF and stroke risk

Causes

include: HTN (increased afterload), infection (cytokine-mediated inflammation), hyperthyroidism (β-adrenergic stimulation), and OSA (hypoxia-induced remodeling)

Effects

Thromboembolism from left atrial appendage (LAA) stasis, HF from rapid ventricular response (RVR), and tachycardia-induced cardiomyopathy

Molecular Pathways

- AF upregulates CaMKII, altering ion channels (IKr, ICaL)
- Inflammation (IL-6, TNF-α) promotes fibrosis via TGF-β
- Thyroid hormone increases Na+/K+-ATPase, shortening action potential

Key Pathway

Trigger (e.g., inflammation, stretch) → Atrial remodeling → AF perpetuation → Thromboembolism, HF

Causes and Differential Diagnosis

Causes

- HTN: Chronic pressure overload, atrial stretch
- HF: Systolic/diastolic dysfunction, volume overload
- CAD: Ischemia, infarction, atrial stunning
- Infection: Sepsis, pneumonia, cytokine surge
- Hyperthyroidism: Increased sympathetic tone, shortened refractory period
- OSA: Nocturnal hypoxia, autonomic dysfunction
- Alcohol: Acute intoxication, chronic cardiomyopathy
- Postoperative: Inflammation, fluid shifts, catecholamines
- Rare: Electrolyte imbalance (hypokalemia, hypomagnesemia), pulmonary embolism (PE), myocarditis, genetic (SCN5A mutations)

Differential Diagnosis

- Atrial Flutter Regular atrial rate (250-350 bpm), sawtooth waves

- Multifocal Atrial Tachycardia (MAT) Multiple P-waves, COPD association
- Supraventricular Tachycardia (SVT) Narrow QRS, paroxysmal
- Ventricular Tachycardia (VT) Wide QRS, life-threatening

Conditions to Rule Out

- Infection (e.g., sepsis, endocarditis) Blood cultures, WBC, CRP
- Thyroid Dysfunction TSH, free T4
- OSA Overnight oximetry, sleep study referral
- PE D-dimer, CTPA
- Electrolyte Imbalance K+, Mg2+, Ca2+

Clinical Presentation

Symptoms

- Palpitations, irregular pulse, fatigue
- Dyspnea, chest pain (ischemia, HF)
- Syncope, dizziness (hemodynamic instability)
- Rare Stroke symptoms (aphasia, hemiparesis), weight loss (thyrotoxicosis), cough (OSA)

Exam

- Irregularly irregular pulse, tachycardia (HR >100 bpm)
- JVD, crackles, S3 (HF)
- Murmurs (valvular disease), thyromegaly (hyperthyroidism)
- Rare Focal neuro deficits (stroke), cyanosis (PE), peripheral edema (HF)

Red Flags

HR >150 bpm, BP <90 mmHg, SpO2 <90%, new neuro deficits, CHA2DS2-VASc ≥2

Labs and Studies

- Labs
- CMP K+ (<3.5 or >5.5 mEq/L), Mg2+ (<1.8 mg/dL), Cr (AKI risk)
- TSH, Free T4 Hyperthyroidism (TSH <0.4 mIU/L)
- CBC Anemia (bleeding risk), leukocytosis (infection)
- BNP >500 pg/mL (HF), troponin (MI)
- Coagulation INR, aPTT (anticoagulation baseline)
- Advanced D-dimer (>500 ng/mL, PE), lactate (sepsis), IL-6 (inflammation)

Imaging

- ECG: Irregularly irregular, no P-waves, variable R-R intervals
- CXR: Pulmonary edema (HF), pneumonia (infection)
- Echocardiogram: LA size (>4 cm), EF (<40%), thrombus
- CTPA :Rule out PE if dyspnea, hypoxia
- Advanced: TEE (LAA thrombus), cardiac MRI (fibrosis)

Other

- CHA2DS2-VASc Score Stroke risk (≥2 indicates anticoagulation)
- HAS-BLED Score Bleeding risk (>3 high risk)
- Overnight Oximetry OSA screening (AHI >15)
- Advanced Holter monitor (paroxysmal AF), genetic testing (familial AF)

Diagnosis

Criteria

ECG showing irregularly irregular rhythm, absent P-waves, variable R-R intervals

Classify as paroxysmal (<7 days), persistent (>7 days), or permanent

Differential

Atrial flutter (sawtooth), MAT (multiple P-waves), SVT (regular), VT (wide QRS)

Flowsheet

- **Step 1** History/Exam Palpitations, irregular pulse, assess triggers (infection, thyroid, OSA)
- **Step 2** Labs CMP, TSH, troponin, D-dimer; rule out infection, PE
- **Step 3** ECG Confirm AF, assess rate, QRS morphology
- **Step 4** Studies Echo (LA size, EF), CXR (HF, infection), TEE if cardioversion
- **Step 5** Risk Stratify CHA2DS2-VASc, HAS-BLED; plan rate/rhythm control, anticoagulation

Management Strategies

General Principles

- Stabilize hemodynamics, control rate/rhythm, prevent thromboembolism, treat underlying causes

- Rate control preferred for persistent AF, rhythm control for new-onset (<48h) or symptomatic AF

Supportive Care

- IV Access: For emergencies, ensure patency
- Monitoring: HR, BP q15min (unstable), q4h (stable), ECG q24h
- Electrolytes: Correct K+, Mg2+ to prevent arrhythmias
- Specific Therapies
    - Rate Control
        - Metoprolol 2.5-5 mg IV q5min (max 15 mg), 25-100 mg PO BID
        - Diltiazem 0.25 mg/kg IV bolus, 5-15 mg/h infusion
        - Digoxin 0.25 mg IV q2h (max 1.5 mg), maintenance 0.125-0.25 mg PO daily
    - Rhythm Control
        - Amiodarone 150 mg IV over 10 min, 1 mg/min x 6h, then 0.5 mg/min
        - Sotalol 80-160 mg PO BID (outpatient initiation)
    - Anticoagulation
        - Apixaban 5 mg PO BID (2.5 mg if Cr >1.5, age >80, weight <60 kg)
    - Heparin 80 units/kg IV bolus, 18 units/kg/h infusion
    - Warfarin INR 2-3, bridge with heparin
    - Cardioversion
        - Synchronized DC cardioversion: 100-200 J (unstable or <48h). TEE-guided if AF >48h or unknown duration, anticoagulate 4 weeks post
    - Ablation Referral: EP consult -> for refractory AF, recurrent symptomatic AF, or young patients (<65)

Non-Pharmacologic

- Catheter ablation (pulmonary vein isolation)
- Pacemaker if bradycardia post-rate control

Complication Management

- Stroke tPA if <4.5h, anticoagulation reversal (PCC for apixaban)
- Bleeding Pressure, FFP, idarucizumab (dabigatran)
- Torsades Magnesium 2 g IV, stop amiodarone

Monitoring

- ECG q24h (QTc, rhythm), CMP q12h (Cr, K+)
- CHA2DS2-VASc, HAS-BLED reassess q48h
- TEE before cardioversion if AF >48h

When to Use Specific Strategies

Rate Control

Persistent AF, elderly, comorbidities (HF, CAD), asymptomatic

Rhythm Control

New-onset AF (<48h), symptomatic, young patients, no structural heart disease

TEE-Guided Cardioversion

AF >48h, unknown duration, high stroke risk (CHA2DS2-VASc ≥2), no anticoagulation history

EP Ablation Referral

Refractory AF after meds, recurrent paroxysmal/persistent AF, patient preference, age <65, no severe comorbidities

Complications

Acute

- Stroke 1-2% annually without anticoagulation, higher with CHA2DS2-VASc ≥2
- Bleeding 2-5% with anticoagulation, GI or ICH most common
- HF Exacerbation 10-20% with RVR, tachycardia-induced cardiomyopathy
- Torsades <1% with amiodarone, sotalol
- Long-Term
- Chronic HF 20-30% with persistent AF, reduced EF
- Cognitive Decline Post-stroke, microvascular ischemia
- Rare Tamponade (ablation, <1%), esophageal fistula (ablation), HIT (heparin)

Clinical Scenarios

Case 1 New-Onset AF with RVR

- Presentation: 55 y/o M with palpitations, chest discomfort, BP 140/90, HR 150 bpm
- Vitals: SpO2 96%, RR 18
- Labs/Studies: ECG AF, no ischemia, TSH 1.0 mIU/L, Cr 0.9 mg/dL, troponin normal, CXR Clear, echo LA 3.8 cm
- Interpretation: New-onset AF with RVR, likely postoperative
- Management: Diltiazem 20 mg IV bolus, 10 mg/h infusion, Apixaban 5 mg PO BID, amiodarone 150 mg IV, HR 85 bpm, sinus rhythm by 12h, discharge day 3

Case 2 Unstable AF with HF

- Presentation: 70 y/o F with dyspnea, BP 85/55, HR 160 bpm
- Vitals: SpO2 90%, RR 24
- Labs/Studies: ECG AF, BNP 1200 pg/mL, Cr 1.5 mg/dL, Troponin 0.3 ng/mL, K+ 4 mEq/L, Echo EF 30%
- Interpretation: Unstable AF, HF exacerbation
- Management: Cardioversion 200 J, heparin infusion, Metoprolol 5 mg IV q6h, furosemide 40 mg IV. Sinus rhythm, BP 110/70 by 24h, ICU transfer

Case 3 Persistent AF for Ablation

- Presentation: 50 y/o M with recurrent palpitations, BP 130/80, HR 110 bpm
- Vitals: SpO2 98%, RR 16
- Labs/Studies: ECG AF, TSH normal, Cr 1 mg/dL, Echo LA 4.2 cm, no thrombus, CHA2DS2-VASc 1
- Interpretation: Persistent AF, symptomatic
- Management: Diltiazem 180 mg PO daily, apixaban 5 mg PO BID, EP consult for ablation, HR 80 bpm, ablation planned outpatient

Expert Tips

- Check TSH, infection, OSA in new-onset AF; treat underlying causes
- Use diltiazem in HF, metoprolol in CAD; target HR 60-110 bpm
- Anticoagulate if CHA2DS2-VASc ≥2; use apixaban over warfarin for ease
- TEE mandatory for cardioversion if AF >48h or no anticoagulation
- Refer to EP for ablation in refractory AF or young patients (<65)

Pitfall

Rapid rate control in HF; hypotension risk with IV beta-blockers

Advanced

Wearable ECG monitors for paroxysmal AF; LAA occlusion (Watchman) for high bleeding risk

Key Pearls

- Rate control (diltiazem, metoprolol) for persistent AF; rhythm control (amiodarone) for new-onset
- Anticoagulate with CHA2DS2-VASc ≥2; apixaban preferred, TEE for cardioversion >48h
- Rule out infection, thyroid, OSA; TSH, cultures, oximetry critical
- EP ablation for refractory or symptomatic AF; refer if <65, minimal comorbidities
- Stroke, bleeding, HF are major risks; monitor ECG, CMP, anticoagulation

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