IDENTIFICATION AND TREATMENT OF ATRIAL ARRHYTHMIAS

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Objectives
1. Identify three common atrial arrhythmias on EKG or telemetry rhythm strip.
2. Describe medical management for both the acute and long term phases of treatment.
3. Describe mechanical and surgical interventions used to treat common atrial arrhythmias.

COMMON TYPES OF ATRIAL ARRHYTHMIAS

- Atrial Tachycardia (AT)
- AV Nodal Re-entrant tachycardia (AVNRT)
- Atrial fibrillation/flutter (a.fib/flutter)
- A.fib = approx. 1/3 of hospitalizations for rhythm disturbances; 66% increase in past 20 years
- A.fib present in 0.4-1% general population; increase with age (8-10%>80 y/o)
- 2.4 million in U.S (5.6m by 2050; > half of all 80+ yr olds)
- Mean cost $8000/a. fib related hospitalization, LOS 3.5 days
- Impairs coronary artery blood flow, decreased cardiac output
- Tachycardia induced cardiomyopathy

### Atrial Fibrillation Demographics by Age

<table>
<thead>
<tr>
<th>Age, yr</th>
<th>U.S. population x 1000</th>
<th>Population with AF x 1000</th>
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</thead>
<tbody>
<tr>
<td>&lt;5</td>
<td>30,000</td>
<td>500</td>
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<tr>
<td>5-9</td>
<td>20,000</td>
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<tr>
<td>10-14</td>
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<td>15-19</td>
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<td>70-74</td>
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<td>75-79</td>
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<td>80-84</td>
<td>500</td>
<td>100</td>
</tr>
<tr>
<td>&gt;85</td>
<td>400</td>
<td>000</td>
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</table>


### PATHOPHYSIOLOGY

- Fibrosis
- Inflammation or dilation
- Fatty infiltration
- Atrial injury
- Pulmonary vein arrhythmogenic foci

Ultimately, atrial architecture changes’ contribution to initiation and maintenance of arrhythmias is not known.
Atrial Tachycardia

- **Definition**
  - Any rapid rhythm originating in the atria
  - Atrial fibrillation and atrial flutter are variations of atrial tachycardia
  - Promotes development of atrial fibrillation

- **EKG Findings**
  - Organized atrial activity
  - Visible P waves
  - Atrial rate 100-180 bpm
  - Narrow QRS
  - Multifocal atrial tach = 3 or more P wave morphologies, varying P-P, PR and R-R

AVNRT

- **Definition**
  - Caused by conduction through reentrant circuit of fast and slow AV nodal pathways
  - Abrupt onset and termination (seconds, minutes, days)
  - Women > men
  - Frequently after age 20 years

- **EKG Findings**
  - Obscure P waves
  - Heart rate 150-250 bpm
  - QRS narrow or may broaden due to rate related aberrancy
  - If fast-slow pathway P wave will be inverted and usually in T wave

Atrial Fibrillation/Flutter

- **Definition**
  - Flutter
    - Stable, uniform atrial activation
    - Type I (Typical, counterclockwise) – stimulus encircles tricuspid annulus → back down free wall
    - Type II (Atypical) – intra-atrial circuit, faster

- **EKG Findings**
  - Flutter
    - Saw-tooth pattern (leads II, III, aVF, V1)
    - Atrial rate 240-320 bpm
    - Commonly with 2:1 AV block; HR 120-160 bpm
Atrial Fibrillation/Flutter

- **Definition**
  - **Fibrillation**
    - Uncoordinated atrial activation

- **EKG Findings**
  - **Fibrillation**
    - No P waves; fibrillatory waves of varying shape, amplitude, timing
    - Irregular, often rapid ventricular response rate
    - Regular R-R intervals if AV block
    - Ventricular rates > 200 bpm, probably accessory pathway vs. VT

Distinguishing Features:
A. fib/flutter

- **Paroxysmal**
  - Lasts up to 7 days
  - Often reoccurs

- **Persistent**
  - 7 days to one year
  - Generally requires pharmacological or electrical intervention
  - Recurrent – 2 or more episodes

- **Permanent**
  - Failed cardioversion (DCCV) or never tried

- **Lone**
  - No structural or mechanical heart disease; younger
Using Gain to Distinguish P-Waves

Gain = 10 mm Hg

Using Gain to Distinguish P-Waves

Gain = 20 mm Hg
MEDICAL MANAGEMENT

- Goals
  1. Rate control
  2. Prevention of thromboembolism
  3. Rhythm control
Precipitants
(Treat the Cause)

- Hyperthyroidism
- Cardiomyopathy (CM)
  - Important to distinguish CM as primary or secondary to a.fib
- Hypertension
- Valve disorders
- Alcohol abuse
- Pericarditis
- Tumor
- Myocardial injury (ischemia or surgery)
- Obstructive sleep apnea

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Sleep Apnea and Cardiovascular Disease
An American Heart Association/American College of Cardiology
Foundation Scientific Statement From the American Heart Association
Council for High Blood Pressure Research-Professional Education
Committee, Council on Clinical Cardiology, Stroke Council, and Council
on Cardiovascular Nursing

(9/2/2008) Downloaded from
www.circ.ahajournals.org

“Cardiac arrhythmias are reportedly more frequent in persons
with OSA and increase with the number of apneic episodes
and the severity of the associated hypoxemia”

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URGENT/EMERGENT MANAGEMENT
ACLS Guidelines

Tachycardia with Pulse

- IV
- 12 Lead EKG
- QRS (>120 ms)
- Narrow QRS (<120ms)
- Wide QRS (>120ms)
- Stable
- Unstable
- Patient Stable?
- Synchronized Cardioversion

Stable
- Reg Rate
- Imag Rate
- Narrow QRS (<120ms)
- Wide QRS (>120ms)
- Vagal maneuvers
- Adenosine
- A fibrillation, A flutter or MAT
- Diltiazem
- B-blocker (caution)
- Reg Rate
- Imag
- VT or uncertain:
  - Amiodarone
  - Cardioversion
  - If SVT with aberrancy:
    - Adenosine

Unstable
- **If unstable: Cardiovert**

ACLS (Cont.)

- Narrow QRS
- Does NOT Convert

Converts (with Adenosine or vagal)
- Probably reentrant SVT, Consider AV nodal blockers
- Possible A. flutter, atrial tachycardia, Junctional tachycardia
- Rate control
- Tx cause
- Consult


LONG-TERM MEDICAL MANAGEMENT
Anticoagulation

- WHY?
  - Increased long term risk of stroke (a.fib/flutter)
  - Nonvalvular a. fib = 6X increased risk

- WHO?
  - CHF
  - HTN
  - Age > 75 years
  - DM
  - Prior stroke or TIA


CHADS 2 SCORE

<table>
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<tr>
<th>Variable</th>
<th>Points</th>
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<tbody>
<tr>
<td>Congestive heart failure</td>
<td>1</td>
</tr>
<tr>
<td>Hypertension</td>
<td>1</td>
</tr>
<tr>
<td>Age ≥ 75 years</td>
<td>1</td>
</tr>
<tr>
<td>Diabetes Mellitus</td>
<td>1</td>
</tr>
<tr>
<td>Prior Stroke/TIA</td>
<td>2</td>
</tr>
</tbody>
</table>

Stroke risk increases with increased points; 6 points = 18.2% risk
Gage, et.al. 2001. JAMA;285:2864-70

CHADSVASC Score

<table>
<thead>
<tr>
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<th>Points</th>
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<tbody>
<tr>
<td>Congestive heart failure</td>
<td>1</td>
</tr>
<tr>
<td>Hypertension</td>
<td>1</td>
</tr>
<tr>
<td>Age ≥ 75</td>
<td>2</td>
</tr>
<tr>
<td>Age 65-74</td>
<td>1</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>1</td>
</tr>
<tr>
<td>Stroke/TIA/thrombo-embolism</td>
<td>2</td>
</tr>
<tr>
<td>Vascular disease*</td>
<td>1</td>
</tr>
<tr>
<td>Sex Female*</td>
<td>1</td>
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</table>

*2014 updated guidelines
http://chadsvasc.org/
Anticoagulation r/t Cardioversion

<table>
<thead>
<tr>
<th>Duration</th>
<th>&lt;48 Hours</th>
<th>&gt; 48 Hours</th>
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</thead>
<tbody>
<tr>
<td>Before:</td>
<td>Not required</td>
<td>Warfarin 3-4 weeks (INR target 2.5) OR Negative TEE</td>
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<tr>
<td>May consider Heparin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>After:</td>
<td>Warfarin for 4 weeks, then:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>*D/C if no risk fx</td>
<td></td>
</tr>
<tr>
<td></td>
<td>*Cont. if risk fx, recurrence likely</td>
<td></td>
</tr>
</tbody>
</table>

2006 ACC/AHA/ESC Practice Guidelines

Revised Guideline:

2014 AHA/ACC/HRS Guideline for the Management of Patients With Atrial Fibrillation: Executive Summary
A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines and the Heart Rhythm Society
Developed in Collaboration With the Society of Thoracic Surgeons

Circulation. published online March 26, 2014
# Anticoagulation Summary

<table>
<thead>
<tr>
<th>Risk Category</th>
<th>Recommended Tx</th>
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<tbody>
<tr>
<td>No Risk</td>
<td>ASA 81 – 325 mg/day</td>
</tr>
<tr>
<td>1 Moderate risk fx</td>
<td>ASA 81-325 mg/day OR Warfarin, INR 2-3</td>
</tr>
<tr>
<td></td>
<td>/anticoagulation</td>
</tr>
<tr>
<td>Any high or &gt;1 Moderate risk fx</td>
<td>Warfarin, INR 2-3/anticoagulation</td>
</tr>
</tbody>
</table>

ACC/AHA/ESC Practice Guidelines 2006/2014

# Anticoagulation Options

- Lovenox
- Warfarin (Coumadin)
- Plavix + ASA
- Dabigatran (Pradaxa)
- Rivaroxaban (Xarelto)
- Apixaban
- Aspirin
  - Better than placebo for a.fib by 20% (SPAF Trial 1993)

# 2011 Revised Guideline:

"Consider Plavix + ASA if warfarin unsuitable, due to patient preference or physician’s assessment of patient’s ability to safely sustain anticoagulation" (Class IIb)

2014 Guideline Update:
Dabigatran (Pradaxa) (active direct thrombin inhibitor)
- Dose 150 mg BID; 75 mg for creat clearance 15-30.
- Rivaroxaban 20 mg daily; avoid if creat clearance < 15
- Apixaban 5 mg BID (avoid if liver impairment)

(http://circ.ahajournals.org/content/early/2014/04/10/CIR.000000000000040)

RE-LY trial: Lancet 2010; 376: 975-83
RATE CONTROL

AFFIRM Trial: Rate vs Rhythm
- No difference in mortality
- No difference in stroke if INR therapeutic
- No significant difference in quality of life or functional capacity

- GOAL: Resting HR 60-80 bpm
  Moderate exercise HR 90-115 bpm
  [2011: resting HR<110 bpm if EF>40%]

- Ca Channel Blockers
  - Diltiazem
  - Verapamil (orally or IV if needed)

- Beta Blockers
  - Metoprolol
  - Propranolol
  - Atenolol
  - If IV needed: Esmolol, Metoprolol, Propranolol

- If Heart failure (no accessory pathway): IV Digoxin or Amiodarone

“What about Digoxin?”

- May slow ventricular response, at rest
- Generally at least 60 mins before tx effect, peak up to 6 hours to develop
- No more effective than placebo in converting a.fib to sinus
- No longer considered 1st line therapy for rapid management except with heart failure/LV dysfunction or sedentary patients
**RHYTHM CONTROL**

**Antiarrhythmic Agents**

- **Amiodarone (oral or IV)**
  - May also be used for rate control if conventional methods ineffective
  - Effective for initial conversion & if present for longer duration
  - Caution: high dose oral loading in patient with decompensated HF or hypotension may result in worsened hemodynamics
  - Be aware of toxicity: pulmonary fibrosis, hepatic, thyroid, proarrhythmic

- **Dronedarone (Multaq)**
  - Oral only, 400 mg BID
  - Benefits of Amiodarone; less toxicity
Multaq (Dronedarone)

Safety Alert:

January, CT et al.
2014 AHA/ACC/HRS Atrial Fibrillation Guideline

Dronedarone should not be used to control the ventricular rate in patients with permanent AF as it increases the risk of the combined endpoint of stroke, MI, systemic embolism, or cardiovascular death (109, 110). (Level of Evidence: B)

Antiarrhythmics (cont.)

- Dofetilide (oral only)
  - Effective in converting atrial flutter and atrial fibrillation
  - Effective for initial conversion & if present for longer duration
  - Ineffective for ventricular rate control
  - Dose by creatinine clearance (125 mcg, 250 mcg, 500 mcg)
- Ibutilide (IV only)
  - Effective in converting atrial flutter and atrial fibrillation
  - Effective for initial conversion & if present for longer duration
  - Ineffective for ventricular rate control
- Propafenone (oral or IV)
  - Effective for initial conversion
  - Mild beta-blocking effects
  - Generally not sufficient to slow AV node conduction
  - Usually need additional agent for ventricular rate control
- Flecainide (Oral or IV)
  - Effective for initial conversion
  - Less effective for arrhythmias lasting > 7 days
  - Avoid if structural heart disease due to significant proarrhythmic affects

“What happened to Sotalol?”

- Not effective in converting atrial arrhythmias
- May be used to maintain sinus rhythm
- Effective in suppressing symptoms if atrial fibrillation reoccurs
- Avoid: asthma, heart failure, renal insufficiency, prolonged QT
"You’re Out!"

- Unproven efficacy or no longer recommended:
  - Digoxin
  - Procainamide
  - Quinidine
  - Verapamil & Diltiazem (for antiarrhythmic effects)

INTERVENTIONS

A. Direct-Current Cardioversion (DCCV)

  - When?
    - Urgently if ventricular rates not responsive to pharmacological therapies
    - Hemodynamically unstable patient
    - Restore sinus rhythm as part of long-term management
    - In conjunction with pre-loaded antiarrhythmics
      - Amiodarone
      - Ibutilide
      - Sotalol
      - Propafenone
      - Flecainide
    - Assure measures for prevention of thromboembolism taken pre-cardioversion
B. Device Therapies

- Internal atrial defibrillators
  - Studied, shock more concerning than arrhythmia symptoms

- Dual chamber pacing
  - Suppresses PACs, AV synchrony prevents retrograde conduction (AVNRT)

- Atrial Overdrive pacing

- Atrial Fibrillation Suppression pacing
  - Increases % of atrial pacing to suppress PACs; decreases atrial cycle length to prevent a.fib
  - Effectiveness as primary therapy for prevention of recurrence has not been proven

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MINERVA study
Minimize Right Ventricular Pacing to Prevent Atrial Fibrillation and Heart Failure

- Atrial preventive pacing
- Atrial antitachycardia pacing
- Managed ventricular pacing

61% reduction in atrial fibrillation

- 2-yr incidence of permanent AF 3.3% (compared to 9.2% with conventional pacing)

www.ecardiologynews.com
C. Radiofrequency Ablation (RFA)

- Cessation of rhythm by creating linear scars in atrial endocardium

- Effectively used to terminate:
  - AVNRT
  - Atrial flutter (80-90% success)
  - Atrial fibrillation (~65-70%)
    - Pulmonary vein isolation
  - AV Nodal
    - Absolute last resort – pacemaker dependent

RFA Risks

- Pulmonary vein stenosis
- Thromboembolism (stroke incidence 0-5%)
- Atrioesophageal fistula
- Left atrial flutter

Posteroanterior (PA) views of four maps from four patients: N
D. MAZE Procedure

- Done in conjunction with valve repair/replacement.
- Hypothesis: reentrant circuits are predominant mechanism, therefore atrial incisions at specific locations would create barriers to conduction.
- Generally used to treat atrial flutter or fib.
- Transmural lesions isolate pulmonary veins and mitral valve annulus to create barrier in right atrium that prevents reentry.
- Success rates reported 70-95%.
- Technique includes: cut & sew, radiofrequency, cryoablation, microwave energy.

The operative field seen from the surgeon's side after the operation is completed
PREVENTING RECURRENCE

Pre and Intra-Op Medications
- Oral beta blockers for patients having cardiac surgery
- Pre-op Amiodarone decreases post-op incidence and is appropriate for patients at high risk for post op arrhythmias.
  - No consensus on proven protocol (≥400-600 mg/day)

Manage Risk Factors
- ACEI + Diuretics after a. flutter RFA significantly reduced incidence of a. fib. (ARB if ACEI not tolerated or contraindicated)
- Optimize heart failure management
- Treat HTN (goal < 130/80)
- Treat thyroid disease (beta blockers or Ca channel blockers until euthyroid)
- Correct valve disorders
- Treat/Optimize treatment of myocardial ischemia (Sotalol is preferred antiarrhythmic for this population)
- Treat obstructive sleep apnea (CPAP, BiPAP, wt loss)
ARREST-AF Cohort Study
Aggressive Risk Factor Reduction Study for Atrial Fibrillation and Implications for the Outcome of Ablation

- Aggressive management of risk factors
  - improved long term ablation success
- HTN
- Weight
- Lipids
- Glycemic control
- Tx OSA
- Smoking and alcohol

Pathak, et. al. 2014