Atrial Fibrillation is Common

- #1 sustained cardiac arrhythmia
- >3,000,000 patients
- 1% of US population
- 9% of all those ≥80 yo
- AFib ED visits ↑

Atrial Fibrillation
5 Epidemiologic Facts

- Incidence
- Mortality
- Stroke Risk
- Heart Failure Risk
- CHA₂DS₂-VASc Importance

ED Visits for Atrial Fibrillation Are Dramatically Increasing

Incidence of Atrial Fibrillation by Age

Atrial Fibrillation | Heart Failure
Atrial Fibrillation ↑ Ischemic Strokes

![Graph showing the relationship between ischemic stroke and follow-up in years.](Image)

Atrial Fibrillation ↑ All Cause Mortality

![Graph showing the relationship between all cause mortality and follow-up in years.](Image)

Stroke in AFib and Aflutter By CHA2DS2-VASc

![Graph showing the incidence density of ischemic stroke among AF flutters.](Image)

There Are 5 Causes of Atrial Fibrillation

- Pericardium: Pericarditis
- Myocardium: LVH, Myocarditis
- Endocardium: Endocarditis, Valvular
- Pulmonary: PE, pulmonary hypertension
- Hypersympathetic: Cocaine, amphetamines, hyperthyroid, ETOH withdrawal, caffeine, beta agonists, fever, dehydration

5 Step ED Dx - Rx

- Secure ABCs
- Determine etiology
- Beta Blocker vs Diltiazem for RVR
- Establish stroke risk (CHA2DS2-VASc)
- Cardiovert, Admit or D/C on meds

What are the 5 steps in the treatment of ED patients who present with either new AFib/Flutter or AFib with RVR?
Why is Atrial Fibrillation so dangerous?

Stroke Is The Biggest AF Risk

- 5% year if no anticoagulation
- 10% year if prior CVA or TIA
- Anticoagulation decreases CVA risk by at least 2/3

Atrial Fibrillation Equals an Increased Stroke Risk

- About 0.5-1% per year but can be higher
- 5% if no anticoagulation
- CHA2DS2-VASc – important determinant
- Silent cerebral ischemia by CT/MRI is 20-40%
- AF doubles risk of death from age 55 onward

Always Calculate the Patient’s Score

CHA2DS2-VASc

- CHF (1)
- Hypertension (1)
- Age ≥ 75 (2)
- Age 65 – 74 (1)
- Diabetes Mellitus (1)
- Stroke/ TIA/Thromboembolic (2)
- Vascular (AMI, PVD, Aortic Plaques) (1)
- Sex Female (1)
Stroke Risk and CHADS\textsubscript{2} Score

Which is best for patients: Rate or Rhythm Control

In General: Rate Control is Superior to Rhythm Control

Which is best for patients: Rate or Rhythm Control

- Classic article, 4,060 pts, multicenter
- Average age 70 yo ± 9
- Rate controlled patients had less hospitalizations
- More adverse effects in the rhythm group
- Slightly more deaths too (p = ns; 0.08)

ED Rate vs. Rhythm Control

- Meta-analysis of 4 ED relevant studies
- 1,438 patients with new onset AF
- **Rate control** if older, chronic AF
- **Rhythm** > rate control if < 65 yo and healthy

Rhythm Control

Younger, healthier patients do better with therapy directed at keeping them in sinus rhythm

Rate Control

Older, sicker patients do better with their AF rate controlled

5 Step ED Dx - Rx

Secure ABCs
Determine etiology
Beta Blocker vs Diltiazem for RVR
Establish stroke risk (CHA\textsubscript{2}DS\textsubscript{2}-VASe)
Cardiovert, Admit or D/C on meds
There Are 5 Routine Tests for All New AF Patients

- CBC
- BMP
- Thyroid
- CXR
- Echocardiogram (sooner or later)

Consider Additional Tests

- BNP R/O HF
- Troponin R/O ACS
- Exercise Testing WPW, Inducible, ACS
- TEE Pre cardioversion if AF > 48 hrs duration

A 67 year old woman presents with atrial fibrillation with rapid ventricular response, HR between 140-160. She has a history of HF, is very SOB, and sounds wet. BP is 160/100

Emergency Department Patients With Atrial Fibrillation or Flutter and an Acute Underlying Medical Illness May Not Benefit From Attempts to Control Rate or Rhythm

Is rate control for atrial fibrillation with RVR always the best strategy?

- 416 patients with AF
- All patients had “complex” AF
- Complex = an acute underlying illness
- 2 Canadian University affiliated EDs

Major Complications

- Shock requiring vasopressors
- Intubation or NIPPV
- Bradycardia requiring pacing or meds
- Stroke or embolic complication
- CPR or death
Electrical cardioversion was only effective in 13.3% of these sick patients.

AF Rate or Rhythm Control in Sick Patients Take Homes

- Rarely effective
- Dangerous
- Focus on underlying disease before attempting to control rate or rhythm

A patient presents with likely PSVT – is 6 mg or 12 mg adenosine better?
Adenosine can kill patients with bypass tracks if: **Wide and Irregular**

Adenosine increases rapid bypass tract conduction and can result in very fast refractory VFib

**Don’t Use Adenosine**
- Never give if wide and irregular
- Never give if rate $\leq$ 150
- Never if only slows during vagal stim
- Careful if hx of AFib, Aflutter, MAT
- Careful if hx of CHF, COPD, WPW

**Wide complex Afib and Adenosine =**
A rapid Vfib death
Rate Control in AF with RVR

- Calcium Channel Blockers
  - Diltiazem: 25 mg over 1-2 min, may up to 35 mg over 1-2 min if inadequate response after 5 min

- Beta Blockers
  - Metoprolol: 5 mg IV q 5 min up to 3 doses
  - Esmolol: 0.5 mg/kg over 1 min, 0.05 – 0.1 mg/kg/min titrate to effect

The role of Digoxin in Atrial Fibrillation is controversial – it may increase mortality or be a marker for those who will do poorly regardless of its use

In general – don’t be the one to start it

Is Magnesium effective for rate control in “Rapid” Atrial Fibrillation?

- 450 pts, double-blind, placebo controlled
- 3 groups of pts from 3 Tunisian hospitals
- High dose vs Low dose vs Placebo
- MgSO₄ 9 grams vs 4.5 grams vs Placebo
- Given over 30 minutes

Measured effectiveness as HR < 90 or rate lowering by > 20%

Acad Emerg Med 2018;in press August

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Acad Emerg Med 2018;in press August
This paper is not what it seems

- Essentially all patients got other rate control agents
- 45-50% received Digoxin
- 30% received Diltiazem
- 20% received Beta Blockade

A 47 year old man presents with new onset atrial fibrillation. He has well controlled hypertension and no history of AFib. He felt his heart start to beat “funny” a few hours ago after running?

Can you safely convert rate stable Atrial Fibrillation and Flutter with medication and/or cardioversion?

Safety of ED Cardioversion

- Safe if AF is acute
- Very safe if no thrombus
- Risk of CVA increases over time
- TEE required if onset unknown or > 48 hrs
- New evidence suggests maybe > 12 hrs

Magnesium for Rate Control in AF

Take Homes

- Adjunct? – maybe; Primary – NO
- 2.5 grams or 4.5 grams?
- 9 grams = lots of flushing (10-15%)
- Was very safe, < 1% hypotension
- Read this paper carefully
Risk of CVA S/P Cardioversion without anticoagulants
0-48 hrs onset = 0.7%

- 1,091 pts, mean age 63.9 years, 2010-2012
- 6 academic centers, 84.7% AFib, 15.3%Aflutter
- Clear history of onset ≤ 48 hrs
- Clear 7d history and no thrombus by TEE

Pharmacologic Rhythm Control
- Procainamide used in 85%
- Converted 52.2% of patients
- Use 35-50 mg/min (up to 20 mg/kg)
- Can go faster - but careful!

Synchronized Cardioversion Effectiveness
- 90.0% successful electrical conversion
  - Mean max energy 148 joules
  - 1.4 mean shocks required
**Electrical Conversion**

- AHA recommends 120-200J biphasic
- 50-100J for flutter
- *My bias*: Use highest recommended: 200 or more
- AP or AL – your choice
- Switch positions if unsuccessful

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**Cardioversion for Fib/Flutter**

- Meta-analysis 13 studies
- 836 AP pts vs 856 AL pts
- Trend toward AL > AP if biphasic

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**Neither A-P nor A-L Pad Placement is Superior**

- The Efficacy of Pad Placement for Electrical Cardioversion of Atrial Fibrillation/Flutter: A Systematic Review
  - Scott Richard, MSc, Ian Stahl, MB, MSc, Tanya Khalilovskaya, MD, Sandy Campbell, MD,
  - South Dickson, MB, and Brian R. Reeve, MB, MSc
  - Acad Emerg Med 2014; 21:717-26

- Meta-analysis 13 studies
- 836 AP pts vs 856 AL pts
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**Is Canadian “aggressive care” with cardioversion effective and safe?**

- 80.1% conversion to sinus rhythm
- 1 stroke and no deaths at 30 days
  (89 yo F on coumadin who had spontaneously converted in ED)

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**Study Assumptions and Hypothesis**

- 20 yr AFib admits† 60% in US
- No defined AHA/ACC discharge pathway
- Great care variations US vs Canada
- Future stroke is greatest risk
- AFib/AFlut rarely acutely life-threatening
9/28/2018

**Current Common AFib Pathway**

Most EDs

- H/P, CXR, ECG, basic labs, thyroid
- IV rate control meds
- Cardiology consult
- Echo
- Admit

**St. Joseph Murphy Algorithm**

Exclusions and Admit

- Underlying Acute Illness (sepsis, PE, etc.)
- Acute Coronary Syndrome
- Acute Heart Failure
- Syncope
- Hemodynamic instability

**High Risk AF Patients**

<table>
<thead>
<tr>
<th>“Major”</th>
<th>“Minor”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cr &gt; 2.26</td>
<td>COPD</td>
</tr>
<tr>
<td>+ Troponin</td>
<td>Dementia</td>
</tr>
<tr>
<td>Furosemide required</td>
<td>Cancer</td>
</tr>
<tr>
<td>HF</td>
<td>↑ Age</td>
</tr>
<tr>
<td>Not on anticoagulation</td>
<td>HAS-BLED &gt; 3</td>
</tr>
<tr>
<td>INR &gt; 3</td>
<td></td>
</tr>
</tbody>
</table>

**Which Atrial Fibrillation patients are at highest risk for a poor outcome**

- 3,510 patients, 24 Canadian EDs
- 2,343 pts for derivation, 1,167 in validation
- 11 variables predict patients at higher risk
- Provides guidance on admission to hospital
Synchronized cardioversion not focus
Rate-control IV meds discouraged
Not specifically stated by patients almost all < 48 hr onset of AFib/AFlut
About ½ “low morbidity”
¼ HF Hx, ¼ CAD, 1/8 DM

NOTE
Pharmacological conversions not attempted
IV rate control discouraged
50 mg PO Metoprolol
120-180 mg PO Diltiazem ER
D/C cardioversion not increased

Additional Findings
Cardioversion rates pre : post:
- 21.2% vs 17.2%
3 day ED return for any reason:
- 1.19 vs 1.0%
30 day ED returns:
- 3.8% vs 3.0%
90% followed up in AFib clinic
10% went outside system

Simplified AFib Discharge Pathways
Take Homes
Single center trial
Very simple, very impressive
< 48 hr not specifically cited
↑ stroke risk?
This protocol will be used

Do patients you see in new AFib need to be anticoagulated…?
How about if you can convert them?
Non-vitamin K anticoagulants now endorsed in ACC/AHA guidelines.

Check carefully for use/dosage in CRF, valvular disease, obese, and s/p cardioversion.

Non-Vitamin K Anticoagulants
Novel Oral Anticoagulants
Direct Oral Anticoagulants

- Apixaban
- Dabigatran
- Edoxaban
- Rivaroxaban

Eliquis anti-xa
Pradaxa direct antithrombin
Savaysa anti-xa
Xarelto anti-xa

Results

Less than 1 in 5 prescribed anticoagulation

- High stroke risk and low/int bleed risk not correlation with increase likelihood of Rx
- Almost 2/3 of Rxs: Warfarin
Are the non-vitamin K oral anticoagulants safer than Warfarin?

- 76,354 pts
- Compared each non-vit K drug to Warfarin
- Apixaban lowered stroke risk 33% vs Warfarin
- Apixaban and dabigatran lowered GI bleed risk
- All decreased risk of intracranial bleeding

Warfarin use is decreasing and is becoming relegated to mainly those patients with:
- Mechanical Heart Valves
- Mitral Stenosis
- Chronic Renal Failure

Anticoagulation and ED Discharge

If you don’t discharge a patient on a non-vitamin K antagonist when indicated, it can take weeks-months for it to be started…and allow a preventable stroke to occur

How often do we not follow current recommended anticoagulation guidelines for high risk AFib patients?

- Two populations: CHADS$_2$ ≥ 2 and CHA$_2$DS$_2$VASc ≥ 2
- 38.2% of 210,380 CHADS$_2$ ≥ 2 got only ASA
- 40.2% of 294,642 CHA$_2$DS$_2$VASc ≥ 2 got only ASA
- More than 1 in 3 high risk for stroke AF pts treated below the standard of care!

Non-vitamin K oral anticoagulants are here

Become expert in using one
Are we dosing non-vitamin K antagonists correctly?

- 5,738 pts from the ORBIT-AF II Registry
- Routine lab evaluation not required with NOACs
- Considered safer than Warfarin
- Some patients require dosing modifications

Take Homes
Non Vitamin K Oral Anticoagulants

NOACs

- 1 in 8 AF patients are dosed incorrectly
- Under and over dosing increases morbidity and mortality
- Do not discharge patients with renal impairment on a NOAC without working with an ED or hospital pharmacist and/or an AFib focused cardiologist

Cardioversion Recommendations

Clear onset < 48 hrs
or
Adequately anticoagulated ≥ 4 weeks

Anticoagulation Recommendations

CHADS2-VASc score ≥ 2
Electrical Conversion

200 J A-P pad placement

Pharmacological Conversion

- Pretreat with 2 grams MgSO₄ over 30 min
- 1 gram Ibutilide over 10 min
- May repeat 10 min after 1st dose
- Monitor for Torsades x 4 hrs
- Do not use if: QTC > 450 msec; Hypo K; EF < 30%

Ibutilide

- Class III antiarrhythmic, K channel blockade
- Slowed repolarization with ↑ QTc
- Usual dose: 1 mg x 2, 10 minute interval
- VTACH and/or Torsade's up to 5% each
- Almost always within 45 min – 1 hr

Highest Risk for Ibutilide (% in this study)

- Heart Failure patients (5%)
- Prolonged QTc (29.4% > 480 mg)
- Hypokalemia (3.1% < 3.5 meq)
- Hypomagnesemia (0.9% < 1.6 meq/L)
Methods

- 69% received rate reducing meds
- Most received Diltiazem
- Half also received 1-2 grams MgSO₄
- 2/3 pre-Ibutilide Cardiology consult

Results

- 44% conversion to NSR at 90 min
- 54.8% to NSR at 4 hrs
- 75% conversion for Atrial Flutter
- 91.8% electrical cardioversion s/p Ibutilide
- 0.6% VTach incidence – both s/p 2nd dose

Ibutilide Take Homes

- Great pre cardioversion
- Not impressive alone
- Similar to procainamide
- Requires 4 hrs of monitoring
- Can be used if hypok/hypomag *
  *But give 2 grams MgSO₄ pre-drug!

5 Step ED Dx - Rx

- Secure ABCs
- Determine etiology
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- Establish stroke risk (CHA₂DS₂-VASc)
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Summary

- Atrial Fibrillation is common
- Stroke is high risk
- Always calculate CHA₂DS₂-VASc score
- Anticoagulate if indicated
  2 = yes, 0 = no, 1 = yes or discuss
Summary

Treat underlying conditions
Dilt or BB for rate control
Cardioversion can be safe < 12-48 hrs
Antiarrhythmics convert half
200 Joules biphase works 90%

Discharging Atrial Fibrillation
Take Homes

• As risks for mortality †, we should be more cautious
• Although authors provide score, I recommend looking at patients and how many increased risk factors they have
• If any major risk factor present: Admit or ask Cardiology to discharge

Cerebral Edema

Study shows more than a 4x increase incidence of cerebral edema with NSS vs LR (3.6% vs 0.8%)

However 5.9% of NSS had “severe” or “extreme” DKA vs only 1.6% treated with LR or about 4x as many seriously ill patients at risk for cerebral edema

30 Day Mortality

Is LR superior to NSS in Pediatric DKA?

• 49,737 pts ages 0-17, retrospective study
• Pediatric Health Information System Database
• 43,841 NSS vs 1,762 (4%) LR
• Most DKA “mild to moderate”
• Evaluated LOS and incidence of cerebral edema