Living with Atrial Fibrillation

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Kansas City, KS
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Disclosures

• Medtronic: Speaker
• Boston Scientific: Speaker
Outline

• Overview of atrial fibrillation
• Detection: Wearables & loop recorders
• Risk factors & lifestyle management
• Stroke prevention
• Medical management
• Ablation
Atrial Fibrillation
Atrial Fibrillation increases risk of:

- Blood clots
- Stroke
- Heart failure

“CardioSmart Explorer” iOS App/ACC and medmovie.com
Causes of Atrial Fibrillation

- Other Diseases (HTN, OSA, Valve disease, heart failure, hypertrophic cardiomyopathy)
- Environment (Tobacco, etc)
- Acquired (Age, EtOH, Exercise)
- Genetic

Tobacco, Exercise)
Wearables: Optical HR sensor

• Measures the pulse
  – Uses photoplethysmography (PPG)

• Advantages
  – More frequent monitoring than ECG detection (frequent intervals)
  – Multitude of watch/phone companies

• Disadvantage
  – Indirect measurement of heart signals (not an ECG)
Wearables: ECG

• **Good News**
  – Detecting lots of atrial fibrillation (and false positives or “indeterminate” too)
  – Early detection = Less strokes
  – Earlier detection/treatment and better outcomes

• **Concerns**
  – Only at time of checking ECG (not continuous monitoring)
  – False positives (PVCs)
  – Resource utilization and management pathways
  – Billing pathways
  – Anxious patient
Case: 49 year-old man...

• Cryptogenic stroke
  – Presented with aphasia
  – Received thrombolytics
  – Minimal residual right-sided deficits
• US: Right ICA 30% stenosis
• 30-day looping event monitor negative

What is the best next step?

A. EP study
B. Carotid endarterectomy
C. Start anticoagulation for probable atrial fibrillation
D. Implantable loop recorder (ILR) implant
Cryptogenic Stroke

- Prospective randomized trial:
  - Conventional follow-up to assess for AF
  - Insertable cardiac monitor
- Population:
  - 441 patients with cryptogenic stroke
  - >40 years old with negative 24 hour ECG monitoring
- Endpoint:
  - Time to >30 seconds of AF within 6 months

Sanna et al. NEJM 2014 (CRYSTAL AF)
Cryptogenic Stroke

• Findings:
  – 6 months: AF detection 8.9% in monitoring vs. 1.4% in conventional (p<0.001)
  – 36 months: AF detection in 30% in monitoring and 3.0% in conventional (p<0.001)
  – 84 days = Median time to detection of AF in cryptogenic stroke patients
  – 88% of patients would have been missed if only monitored for 30 days

• Summary: Implantable monitor improves detection of AF in patients with cryptogenic stroke

Sanna et al. NEJM 2014 (CRYSTAL AF)
An artificial intelligence-enabled ECG algorithm for the identification of patients with atrial fibrillation during sinus rhythm: a retrospective analysis of outcome prediction

When to consider ILR implantation?

<table>
<thead>
<tr>
<th>Cryptogenic stroke</th>
<th>Syncope</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-AF Monitoring</td>
<td>Infrequent arrhythmias</td>
</tr>
</tbody>
</table>
Alcohol

• Data
  – Probable dose-response relationship\(^1,2\)
  – Moderate or more alcohol associated with increased incidence of atrial fibrillation
  – Possible higher risk with liquor > wine > beer\(^2\)

\(^1\)Samokhvalov et al. Eur J Cardiovasc Prev Rehab
\(^2\)Larsson et al. 2014 JACC
Caffeine

• Summary:
  – No evidence of harm with low, moderate, or high caffeine intake
  – Possible protective effect of low caffeine intake

“A regular intake of up to 300 mg/day appears to be safe and may even be protective against heart rhythm disorders”

Sleep Apnea

Differential Association of Exercise Intensity With Risk of Atrial Fibrillation in Men and Women: Evidence from a Meta-Analysis

- **Men:**
  - Moderate intensity exercise lowers risk of AF
  - High intensity exercise increases risk of atrial fibrillation

- **Women:**
  - Moderate AND high intensity exercise decreases risk for atrial fibrillation

REVERSE-AF (Cohort Study)

Middeldorp et al. Europace. 2018 Dec 1;20(12):1929-
Yoga

• Single center 3 month study
  – 49 paroxysmal atrial fibrillation patients
  – 3 months control → 3 months of 2x per week 60 minute yoga training

• Results
  – Reduced symptomatic atrial fibrillation episodes
  – Improved QoL parameters
  – Reduced depression and anxiety

Case: 47 year-old woman

- HTN, DM, Asthma
- **Class III Obesity** (BMI 47.8) – recent gastric bypass surgery
- **Paroxysmal atrial fibrillation**
  - Symptomatic
  - Breakthrough despite dofetilide (Tikosyn)

What is the best next step?

A. Wait for BMI <35 prior to ablation
B. AF surgical ablation
C. AF catheter ablation
D. Amiodarone
Concurrent Management

Lifestyle Modification
- Dx/Tx of Sleep Apnea
- Weight Loss
- Moderate exercise
- Reduction/elimination EtOH

+ Medical / Ablation Therapy

Improved AF Outcomes
- Reduction of stroke risk
- Quality of Life
- Burden of AF
Management of stroke risk (Anticoagulation and/or LAA closure) + Medical therapy (Rate ± AAD) and/or Ablation
Table 2—The 2009 Birmingham Schema Expressed as a Point-Based Scoring System, With the Acronym CHA\textsubscript{2}DS\textsubscript{2}-VASc

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Congestive heart failure/LV dysfunction</td>
<td>1</td>
</tr>
<tr>
<td>Hypertension</td>
<td>1</td>
</tr>
<tr>
<td>Age $\geq 75$ y</td>
<td>2</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>1</td>
</tr>
<tr>
<td>Stroke/TIA/TE</td>
<td>2</td>
</tr>
<tr>
<td>Vascular disease (prior myocardial infarction, peripheral artery disease, or aortic plaque)</td>
<td>1</td>
</tr>
<tr>
<td>Age 65-74 y</td>
<td>1</td>
</tr>
<tr>
<td>Sex category (ie female gender)</td>
<td>1</td>
</tr>
</tbody>
</table>

LV = left ventricular; TE = thromboembolism. See Table 1 for expansion of other abbreviations.
Table 2: Event rate (95% CI) of hospital admission and death due to thromboembolism* per 100 person years

<table>
<thead>
<tr>
<th>Score/risk category</th>
<th>1 year’s follow-up</th>
<th>5 years’ follow-up</th>
<th>10 years’ follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CHADS2:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low risk (0)</td>
<td>1.67 (1.47 to 1.89)</td>
<td>1.28 (1.19 to 1.38)</td>
<td>1.24 (1.16 to 1.33)</td>
</tr>
<tr>
<td>Intermediate risk (1)</td>
<td>4.75 (4.45 to 5.07)</td>
<td>3.70 (3.55 to 3.86)</td>
<td>3.56 (3.42 to 3.70)</td>
</tr>
<tr>
<td>High risk (2-6)</td>
<td>12.27 (11.84 to 12.71)</td>
<td>8.30 (8.08 to 8.51)</td>
<td>7.97 (7.77 to 8.17)</td>
</tr>
</tbody>
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<tr>
<td><strong>CHA2DS2-VASc:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>0.78 (0.58 to 1.04)</td>
<td>0.69 (0.59 to 0.81)</td>
<td>0.66 (0.57 to 0.76)</td>
</tr>
<tr>
<td>1</td>
<td>2.01 (1.70 to 2.36)</td>
<td>1.51 (1.37 to 1.67)</td>
<td>1.45 (1.32 to 1.58)</td>
</tr>
<tr>
<td>2</td>
<td>3.71 (3.36 to 4.09)</td>
<td>3.01 (2.83 to 3.20)</td>
<td>2.92 (2.76 to 3.09)</td>
</tr>
<tr>
<td>3</td>
<td>5.92 (5.53 to 6.34)</td>
<td>4.41 (4.21 to 4.61)</td>
<td>4.28 (4.10 to 4.47)</td>
</tr>
<tr>
<td>4</td>
<td>9.27 (8.71 to 9.86)</td>
<td>6.69 (6.41 to 6.99)</td>
<td>6.46 (6.29 to 6.74)</td>
</tr>
<tr>
<td>5</td>
<td>15.26 (14.35 to 16.24)</td>
<td>10.42 (9.95 to 10.91)</td>
<td>9.97 (9.53 to 10.43)</td>
</tr>
<tr>
<td>6</td>
<td>19.74 (18.21 to 21.41)</td>
<td>12.85 (12.07 to 13.69)</td>
<td>12.52 (11.78 to 13.31)</td>
</tr>
<tr>
<td>7</td>
<td>21.50 (18.75 to 24.64)</td>
<td>13.92 (12.49 to 15.51)</td>
<td>13.96 (12.57 to 15.51)</td>
</tr>
<tr>
<td>8</td>
<td>22.38 (16.29 to 30.76)</td>
<td>14.07 (10.80 to 18.33)</td>
<td>14.10 (10.90 to 18.23)</td>
</tr>
<tr>
<td>9</td>
<td>23.64 (16.62 to 52.61)</td>
<td>16.08 (8.04 to 32.15)</td>
<td>15.89 (7.95 to 31.78)</td>
</tr>
</tbody>
</table>

**CHADS2-VASc:**

<table>
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<td>Intermediate risk (1)</td>
<td>2.01 (1.70 to 2.36)</td>
<td>1.51 (1.37 to 1.67)</td>
<td>1.45 (1.32 to 1.58)</td>
</tr>
<tr>
<td>High risk (2-9)</td>
<td>8.82 (8.55 to 9.09)</td>
<td>6.01 (5.88 to 6.14)</td>
<td>5.72 (5.69 to 5.84)</td>
</tr>
</tbody>
</table>

*Includes peripheral artery embolism, ischaemic stroke, and pulmonary embolism.

Olesen et al. BMJ. 2011 Jan 31;342:d124.
### Class I: AC for CHA\textsubscript{2}DS\textsubscript{2}-VASc 2+ men, 3+ women

1. For patients with AF and an elevated CHA\textsubscript{2}DS\textsubscript{2}-VASc score of 2 or greater in men or 3 or greater in women, oral anticoagulants are recommended.

Options include:
- Warfarin (LOE: A)\textsuperscript{54.1.1-5,54.1.1-7}
- Dabigatran (LOE: B)\textsuperscript{54.1.1-8}
- Rivaroxaban (LOE: B)\textsuperscript{54.1.1-9}
- Apixaban (LOE: B)\textsuperscript{54.1.1-10} or Edoxaban (LOE: B-R)\textsuperscript{54.1.1-11}

**MODIFIED:** This recommendation has been updated in response to the approval of edoxaban, a new factor Xa inhibitor. More precision in the use of CHA\textsubscript{2}DS\textsubscript{2}-VASc scores is specified in subsequent recommendations. The LOEs for warfarin, dabigatran, rivaroxaban, and apixaban have not been updated for greater granularity as per the new LOE system. (Section 4.1. in the 2014 AF Guideline) The original text can be found in Section 4.1 of the 2014 AF guideline. Additional information about the comparative effectiveness and bleeding risk of NOACs can be found in Section 4.2.2.2.

### Class IIa: Omit AC for CHA\textsubscript{2}DS\textsubscript{2}-VASc 0 men, 1 women

12. For patients with AF (except with moderate-to-severe mitral stenosis or a mechanical heart valve) and a CHA\textsubscript{2}DS\textsubscript{2}-VASc score of 0 in men or 1 in women, it is reasonable to omit anticoagulant therapy.\textsuperscript{54.1.1-24,54.1.1-25}

**MODIFIED:** Exclusion criteria are now defined as moderate-to-severe mitral stenosis or a mechanical heart valve. (Section 4.1. in the 2014 AF Guideline)

### Class IIb: Consider AC for CHA\textsubscript{2}DS\textsubscript{2}-VASc 1 men, 2 women

15. For patients with AF (except with moderate-to-severe mitral stenosis or a mechanical heart valve) and a CHA\textsubscript{2}DS\textsubscript{2}-VASc score of 1 in men and 2 in women, prescribing an oral anticoagulant to reduce thromboembolic stroke risk may be considered.\textsuperscript{54.1.1-31,54.1.1-35}

**MODIFIED:** Exclusion criteria are now defined as moderate-to-severe mitral stenosis or a mechanical heart valve, and evidence was added to support separate risk scores by sex. LOE was updated from C to C-LD. (Section 4.1. in the 2014 AF Guideline)
## Direct Oral Anticoagulant vs. Warfarin

### 2. NOACs (dabigatran, rivaroxaban, apixaban, and edoxaban) are recommended over warfarin in NOAC-eligible patients with AF (except with moderate-to-severe mitral stenosis or a mechanical heart valve)  

NEW: Exclusion criteria are now defined as moderate-to-severe mitral stenosis or a mechanical heart valve. When the NOAC trials are considered as a group, the direct thrombin inhibitor and factor Xa inhibitors were at least noninferior and, in some trials, superior to warfarin for preventing stroke and systemic embolism and were associated with lower risks of serious bleeding.

### Why?

- Less risk of intracranial bleeding
- Noninferior and in some trials SUPERIOR to Warfarin for preventing stroke

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2019 AHA/ACC/HRS focused update of the 2014 AHA/ACC/HRS guideline  
Case: 76 year-old man…

- Hypertrophic cardiomyopathy
- Permanent atrial fibrillation
- CHA$_2$DS$_2$-VASc N/A
- Recurrent epistaxis
  - Recurrent with Xarelto 20 mg daily (CrCl >50)
  - Multiple ED visits despite conservative management

What is the best next step?

A. Discontinue anticoagulation and start aspirin 81 mg daily & clopidogrel 75 mg daily
B. Discuss left atrial appendage occlusion
C. Reduce Xarelto to 15 mg daily
D. Atrial fibrillation ablation (to lower risk of stroke)
"CardioSmart Explorer" iOS App/ACC and medmovie.com
5 Year Outcomes PREVAIL and PROTECT-AF Trials

Thoughts on LAA Occlusion

- Good option for patients intolerant to anticoagulation
- Caution in absence of contraindication to oral AC or high bleeding risk
  - Not compared in randomized trial to DOAC
  - 3.7% incidence of DRT (device-related thrombosis)
    - 26% Post-procedure stroke or systemic embolism in these patients
- Caution without ability to tolerate short-term anticoagulation

**A COMPARISON OF RATE CONTROL AND RHYTHM CONTROL IN PATIENTS WITH ATRIAL FIBRILLATION**

THE ATRIAL FIBRILLATION FOLLOW-UP INVESTIGATION OF RHYTHM MANAGEMENT (AFFIRM) INVESTIGATORS*

- 4060 patients
- Randomized to:
  - Rate Control
  - Rhythm Control with AAD (not ablation)

---

**Figure:**

- Cumulative Mortality (%)
- Years

**Table:**

<table>
<thead>
<tr>
<th>Drug</th>
<th>Rate-Control Group</th>
<th>Rhythm-Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Used Drug</td>
<td>For Initial Therapy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>At Any Time</td>
</tr>
<tr>
<td></td>
<td>Sodium Amilodipine</td>
<td>2 (0.2)†</td>
</tr>
<tr>
<td></td>
<td>Sorbital</td>
<td>1 (0.1)†</td>
</tr>
<tr>
<td></td>
<td>Propafenone</td>
<td>2 (0.2)†</td>
</tr>
<tr>
<td></td>
<td>Procainamide</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Quinidine</td>
<td>2 (0.2)†</td>
</tr>
<tr>
<td></td>
<td>Flecaidine</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Disopyramide</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Moricizine</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Doxetilde</td>
<td>0</td>
</tr>
</tbody>
</table>

- Data available: 1265
- Used Drug: 2027
- Used Drug: 1960
- Used Drug: 2033

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**Figure 7: Strategies for Rhythm Control in Patients With Paroxysmal* and Persistent AF**

*Catheter ablation is only recommended as first-line therapy for patients with paroxysmal AF (Class IIa recommendation).
†Drugs are listed alphabetically.
‡Depending on patient preference when performed in experienced centers.
§Not recommended with severe LVH (wall thickness >1.5 cm).
∥Should be used with caution in patients at risk for torsades de pointes ventricular tachycardia.
¶Should be combined with AV nodal blocking agents.
AF indicates atrial fibrillation; AV, atrioventricular; CAD, coronary artery disease; HF, heart failure; and LVH, left ventricular hypertrophy.
“CardioSmart Explorer” iOS App/ACC and medmovie.com
After failure of ≥1 AAD

ThermoCool AF Trial

Prior to AAD

RAAFT-2 Trial
<table>
<thead>
<tr>
<th>Indications for catheter ablation of atrial fibrillation</th>
<th>Recommendation</th>
<th>Class</th>
<th>LOE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Indications for catheter ablation of atrial fibrillation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Symptomatic AF</strong></td>
<td><strong>Paroxysmal:</strong> Catheter ablation is recommended.</td>
<td>I</td>
<td>A</td>
</tr>
<tr>
<td><strong>refractory or intolerant to at least one Class I or III antiarrhythmic medication</strong></td>
<td><strong>Persistent:</strong> Catheter ablation is reasonable.</td>
<td>IIa</td>
<td>B-NR</td>
</tr>
<tr>
<td></td>
<td><strong>Long-standing persistent:</strong> Catheter ablation may be considered.</td>
<td>IIb</td>
<td>C-LD</td>
</tr>
<tr>
<td></td>
<td><strong>Paroxysmal:</strong> Catheter ablation is reasonable.</td>
<td>IIa</td>
<td>B-R</td>
</tr>
<tr>
<td><strong>Symptomatic AF prior to initiation of antiarrhythmic therapy with a Class I or III antiarrhythmic medication</strong></td>
<td><strong>Persistent:</strong> Catheter ablation is reasonable.</td>
<td>IIa</td>
<td>C-E0</td>
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<td></td>
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<td>C-E0</td>
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2017 HRS/EHRA/ECAS/APHRS/SOLAECE expert consensus statement on catheter and surgical ablation of atrial fibrillation.

Effect of Catheter Ablation vs Antiarrhythmic Drug Therapy on Mortality, Stroke, Bleeding, and Cardiac Arrest Among Patients With Atrial Fibrillation The CABANA Randomized Clinical Trial
Primary Endpoint: Intention to Treat

- 2204 patients with symptomatic atrial fibrillation
  - 126 centers, 10 countries
  - ≥65 years old with at least 1 stroke
  - Randomized to catheter ablation vs. medical therapy

Table 1. Baseline Demographics and Clinical Characteristics (continued)

<table>
<thead>
<tr>
<th>Baseline Characteristic</th>
<th>Catheter Ablation (n = 1108)</th>
<th>Drug Therapy (n = 1096)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of AF at enrollment²</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Persistent</td>
<td>524 (47.3)</td>
<td>518 (47.3)</td>
</tr>
<tr>
<td>Paroxysmal</td>
<td>470 (42.4)</td>
<td>476 (43.5)</td>
</tr>
<tr>
<td>Long-standing persistent</td>
<td>114 (10.3)</td>
<td>101 (9.2)</td>
</tr>
</tbody>
</table>

CABANA Trial
Intention to Treat

CABANA Trial

CABANA: Issues

- Intention to Treat Analysis vs. As-Treated
  - Crossover
    - 27.5% of drug group underwent ablation
    - Only 90.8% of Ablation group underwent ablation
AF symptom control is better with catheter ablation than drug therapy (although both achieve improvement)
<table>
<thead>
<tr>
<th>Indications for catheter ablation of atrial fibrillation</th>
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<th>LOE</th>
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<tr>
<td>Symptomatic AF refractory or intolerant to at least one Class I or III antiarrhythmic medication</td>
<td>I</td>
<td>A</td>
</tr>
<tr>
<td>Symptomatic AF prior to initiation of antiarrhythmic therapy with a Class I or III antiarrhythmic medication</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paroxysmal: Catheter ablation is recommended.</td>
<td>IIa</td>
<td>B-R</td>
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<td></td>
</tr>
<tr>
<td>-----</td>
<td>-----</td>
<td></td>
</tr>
<tr>
<td><strong>1.</strong> AF catheter ablation may be reasonable in selected patients with symptomatic AF and HF with reduced left ventricular (LV) ejection fraction (HFrEF) to potentially lower mortality rate and reduce hospitalization for HF.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NEW:** New evidence, including data on improved mortality rate, has been published for AF catheter ablation compared with medical therapy in patients with HF.

Cryoballoon vs. Radiofrequency

- Decreased procedure time & fluoroscopy
- Less esophageal injury
- Less PV stenosis
- Less learning curve
- More discrete lesions
- Less atrial tachycardia

- Less phrenic injury
- More versatile (additional arrhythmias, atrial flutter, etc)
Histology at 1 week

**Cryo**
- Endothelial boundary maintained
- Minimal thrombus
- Fibrosis complete
- Well demarcated

**RF**
- Disrupted endothelial boundary
- Thrombus present
- Hemorrhage still present
- Fibrosis started

Khairy et al. Circulation 2003 (labels by Dr. Gerstenfeld HR BR 2015)
• **Phrenic injury**: 1-2% with monitoring
• **Pulmonary vein stenosis**: <1-2%
• **Atrial-esophageal fistula**: 0.02%-0.1%

<table>
<thead>
<tr>
<th>Variable</th>
<th>Whole cohort (N = 106,105)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vascular complications</td>
<td>1090 (1.0)</td>
</tr>
<tr>
<td>Cardiac complications</td>
<td>2549 (2.4)</td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>110 (0.1)</td>
</tr>
<tr>
<td>Pericardial complications</td>
<td>400 (0.4)</td>
</tr>
<tr>
<td>Hemopericardium</td>
<td></td>
</tr>
<tr>
<td>Cardiac tamponade</td>
<td>1258 (1.2)</td>
</tr>
<tr>
<td>Pericardiocentesis</td>
<td>1870 (1.8)</td>
</tr>
<tr>
<td>Iatrogenic complications</td>
<td>1461 (1.4)</td>
</tr>
<tr>
<td>Respiratory complications</td>
<td>420 (0.4)</td>
</tr>
<tr>
<td>Pneumothorax</td>
<td>219 (0.2)</td>
</tr>
<tr>
<td>Hemothorax</td>
<td>35 (&lt;0.1)</td>
</tr>
<tr>
<td>Iatrogenic complications</td>
<td>165 (0.2)</td>
</tr>
<tr>
<td>Neurological complications</td>
<td>903 (0.9)</td>
</tr>
<tr>
<td>Infectious complications and shock</td>
<td>746 (0.7)</td>
</tr>
<tr>
<td>Any complications*</td>
<td>8063 (7.6)</td>
</tr>
<tr>
<td>Inhospital mortality</td>
<td>464 (0.4)</td>
</tr>
</tbody>
</table>

*whole cohort: 106,105 patients

National Inpatient Sample Database
Conclusions

- Predominant concern with atrial fibrillation is stroke
- Wearables can be helpful in detection of atrial fibrillation
- Lifestyle modification critical adjunctive treatment
- Ablation is better than anti-arrhythmic drugs at improving quality of life
Questions?