Atrial Fibrillation
A Brief Overview!!

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Director, Atrial Fibrillation Wellness Program
Cardiac Arrhythmia Services
Southcoast Health System
Presenter Disclosure Information

Financial Disclosures

• Significant Research Support: National Cardiovascular Database Registry (NCDR and AHA)
Typical EP Patient.....A Metabolic

- Reduced ejection fractions
- ICM, NICM
- Congestive heart failure
- Sometimes decompensated
- Need to limit IV fluids
- Active arrhythmias
  - SVT, VT
- Other comorbid disease
  - COPD
  - Renal failure
  - Diabetes
- Active ischemia
- Periods of hypotension
- ICD testing
Atrial Fibrillation

- What is Atrial Fibrillation
- Is all AF similar?
- Rate Control Strategy…..It’s so much Easier!!
- Rhythm Control
  - Anti-arrhythmic Drugs
  - Cardioversion
  - Ablation
- Stroke Prevention in Atrial Fibrillation
  - Who is a candidate for anticoagulation
  - Watchman Device
Man vs. the Beast!!
Atrial Fibrillation

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Atrial Fibrillation
An Interplay of Substrate & Triggers
Atrial Fibrillation, Hospitalization & Direct Costs

- Outpatient costs: $1.8 billion
- Inpatient Costs (Principal Diagnosis): $2.9 billion
- Inpatient costs (incremental as a co-morbidity): $2.0 billion
- **TOTAL ESTIMATED (2005):** $6.7 billion and growing

Ruskin JN & Singh JP: Heart Rhythm, 2006
Coyne et al, Value in Health, Vol 9, No. 5, 2006 : 348-356
CHF-AF: A Double Whammy!

The combination of AF and HF irrespective of which comes first is associated with a further 2-3 fold increase in mortality.

Wang et al; Circ. 2003; 107:2920
Atrial fibrillation burden increases with severity of heart failure

Despite prevalence, no clear standards for treating this complicated group of patients
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Defining AF: Individualizing Treatment Approaches

- Mechanistic
  - Adrenergic
  - Vagal (sleep-induced)

Camm AJ et al, Europace 2010
Atrial Fibrillation

• What is Atrial Fibrillation

• Is all AF similar? How about Atrial Flutter?

• **Rate Control Strategy**…..It’s so much Easier!!

• Rhythm Control
  – Anti-arrhythmic Drugs
  – Cardioversion
  – Ablation

• **Stroke Prevention in Atrial Fibrillation**
  – Who is a candidate for anticoagulation
  – Watchman Device
Rate Control: where do we stand?

Most patients in Drug Arm did not maintain NSR
Excluded younger patients
Stopped anticoagulation if AAD led to NSR
Most common drug used Amiodarone

Affirm Investigators, NEJM 2002:3471385
Sinus Rhythm versus Rate control: Not tested

Efficacy of Anti-arrhythmic Drugs in Rhythm vs. Rate Control

- The RACE II study shows that lenient rate control is not inferior to strict rate control
- Lenient rate control is more convenient since fewer outpatient visits, fewer examinations, lower doses and less often combination of drugs are needed

Van Gelder et al, NEJM 2010
Rate Control Conclusions

Some take home points:

– Rate therapy equivalent to Rhythm control for hard endpoints
– Quality of life not entirely comparable
– Age cut-offs important
  • **Age <65 yrs not tested for rate control**
– Adverse effects of AAD may offset benefits of SR
– Lenient rate control <110 BPM reasonable if **LVEF is Normal**
Atrial Fibrillation

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  - Anti-arrhythmic Drugs
  - Cardioversion
  - Ablation

- Stroke Prevention in Atrial Fibrillation
  - Who is a candidate for anticoagulation
  - Watchman Device
2013 ACC/AHA/ESC Guidelines: Treatment Algorithms for AF

**MAINTENANCE OF SINUS RHYTHM**

- **No (or minimal) heart disease**
  - Flecainide
  - Propafenone
  - Sotalol
  - Amiodarone
  - Dofetilide
  - Catheter ablation

- **Hypertension**
  - Substantial LVH
    - No
    - Yes
      - Flecainide
      - Propafenone
      - Sotalol
      - Amiodarone
      - Dofetilide
      - Catheter ablation

- **Coronary artery disease**
  - Dofetilide
  - Sotalol
  - Amiodarone
  - Catheter ablation

- **Heart failure**
  - Amiodarone
  - Dofetilide
  - Catheter ablation

Cardioversion

- It’s a mere resetting of the short circuits

- TEE
  - If >48 hours from onset of atrial fibrillation
  - Inadequate anticoagulation
    - INR <2 in the 3 weeks prior to cardioversion
    - Non-Compliance with NOACS

- 4 weeks of Anticoagulation after cardioversion
  - Must no matter what the CHADS2 score
Indications for Catheter Ablation

- **Symptomatic** atrial fibrillation refractory or intolerant to at least one Class I or III antiarrhythmic medication
- Selected symptomatic patients with heart failure and/or reduced ejection fraction

Calkins et al Heart Rhythm 2007: 4: 816
Muscular bands enhancing the electrical continuity between the PV and LA
Cornerstone of AF: Isolating the Pulmonary Vein

S1-VP = 60 ms

S1-VP = 80 ms

Disconnection
Catheter Ablation (Internal view)

Endoscopic View of the LA and the Pulmonary Veins
Image Integration
Intra-procedural display of Ablation points
Published Catheter Ablation Success Rates Compare Favorably to Antiarrhythmic Drugs

Meta Analysis of Radiofrequency Ablation and Antiarrhythmic Drug Studies

- Success rates were higher for ablation than drugs
- Ablation success rates represent a mixed population of paroxysmal (69.8%), persistent (14.9%) and longstanding persistent (13.9%)
- Adverse events were rarer but more severe for ablation – 5% vs. 30% for AAD


* Represents number of publications and patients that contributed to the analysis
Variability in Left Atrial Wall Thickness

- Need to put into perspective the potential for cardiac perforation, collateral damage and venous stenosis

Courtesy Prof A. Becker
Cryoballoon Ablation

- Arctic Front System
  - Inflation cycle
  - Ablation cycle
  - Thawing cycle
- 23 & 28 mm balloon
- Cryo-refrigerant
- Single lesion PV isolation at 90%
- ICE-guided
- 4-min lesion
- Safety needs evaluation

Reddy et al, Heart Rhythm 2008
How Arctic Front Advance™ Cryoballoon and Achieve® Mapping Catheter Work

1. Access targeted vein

2. Inflate and position

3. Occlude and ablate

4. Assess PVI
STOP-AF Results

- Cryo-ablation is feasible and effective
- FDA approved
- Issues:
  - Phrenic nerve palsy
  - Pulmonary vein stenosis

Packer D et al; ACC 2010
Cryo Ablation (post-ablation)
HYBRID AF ABLATION
Ablation of paroxysmal AF was associated with a 35% and 66% larger probability of success as compared to ablation of persistent and longstanding persistent AF, respectively.

Earlier referral for catheter ablation may lead to higher success rates.
Atrial Fibrillation
An Interplay of Substrate & Triggers
SUBTLE™ access enables a transdiaphragmatic approach that provides the ability to access the posterior region of a beating heart. The closed chest approach offers surgeons direct visualization to the posterior of a beating heart through endoscopes, enabling the ability to create bi-atrial, linear lesions without chest incisions or ports.
SUBTLE™ Closed Chest Access
Addressed Technical Limitations

- Better ablation device design / ability to create complete lesions
- Direct visibility (endoscopic)
- Better access (SUBTLE™)
- Posterior isolation

Midline Incision “SUBTLE” Access
Electrosilencing Posterior Left Atrium

Direct Visibility

- AF Foci Located Along PV Tissue
- Posterior LA Derives Embryologically from PVs
- PVI Does Not Address Reentrant Circuits
- Need to Ablate Posterior LA to Prevent Wavelets

SUBTLE Access Enables Visualization & Ablation of Posterior LA
Percutaneous Endocardial Ablation

Percutaneous Access

Breakthrough Locations @ Pericardial Reflections
Multidisciplinary Strategy
Leveraging Best Techniques

- Endocardial Lesions
- Epicardial Lesions

IVC
RA
SVC
PA
Aorta
LV
LA

NavX™
CARTO™
Interesting......How about this Watchman device...what's the deal......?
Atrial Fibrillation

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• Rate Control Strategy…..It’s so much Easier!!

• Rhythm Control
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  – Cardioversion
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• **Stroke Prevention in Atrial Fibrillation**
  – Who is a candidate for anticoagulation
  – Watchman Device
Atrial Fibrillation Population, Stroke Risk and the Left Atrial Appendage

AFib is the most common cardiac arrhythmia

AFib increases risk of stroke

Blood clots form in the left atrial appendage

Many patients are unprotected

> 5M people with AFib in the US

5x greater risk of stroke with AFib

>90% of stroke in AFib is caused by blood clots that form in the left atrial appendage

30 - 40% of patients are unwilling or unable to take Warfarin

Stroke is more severe for patients with AF, as they have a 70% chance of death or permanent disability

1 Holmes DR. Seminars in Neurology. 2010;30:528–536
Fibrillation causes blood to stagnate in the LAA

The stagnant blood becomes an ideal environment for a thrombus or blood clot to form

The blood clot, or portion of it, dislodges from the LAA and travels through arterial system

The embolism lodges itself in the blood vessels of the brain, restricting blood flow and causing a stroke
## New Drugs: Major Bleeding and Hemorrhagic Stroke Rates

<table>
<thead>
<tr>
<th>Study</th>
<th>Treatment</th>
<th>Major Bleeding</th>
<th>Hemorrhagic Stroke</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RE-LY(^\text{1})</strong></td>
<td>Dabigatran (110 mg)</td>
<td>2.71%</td>
<td>0.12%</td>
</tr>
<tr>
<td></td>
<td>Dabigatran (150 mg)</td>
<td>3.11%</td>
<td>0.10%</td>
</tr>
<tr>
<td></td>
<td>Warfarin</td>
<td>3.36%</td>
<td>0.38%</td>
</tr>
<tr>
<td><strong>ROCKET-AF(^\text{2})</strong></td>
<td>Rivaroxaban</td>
<td>3.6%</td>
<td>0.5%</td>
</tr>
<tr>
<td></td>
<td>Warfarin</td>
<td>3.4%</td>
<td>0.7%</td>
</tr>
<tr>
<td><strong>ARISTOTLE(^\text{3})</strong></td>
<td>Apixaban</td>
<td>2.13%</td>
<td>0.24%</td>
</tr>
<tr>
<td></td>
<td>Warfarin</td>
<td>3.09%</td>
<td>0.47%</td>
</tr>
</tbody>
</table>

1 Connelly SJ et al, *NEJM* 2009;361:1139-51
Despite Increasing NOAC Adoption, Overall Rate of Anticoagulation in High Risk NVAF Patients has Not Improved

Anticoagulant Use in Patients with NVAF and CHADS$_2$ ≥ 2

Results from the NCDR PINNACLE Registry$^1$

Interventions on LAA: Why Mixed Success? LAA Anatomy

• LAA forms during the third week of gestation and serves as the left atrium in the fetus
  – Adult LAA is the about the size of a thumb
  – Ostium range may range from 10 - 40mm

LAA anatomy varies in shape.
• In one patient study of 932 AF patients\(^1\) LAAs were grouped into 4 categories:
  - Cactus (30%)
  - Chicken Wing (48%)
  - Windsock (19%)
  - Cauliflower (3%)

1. Biase et al. JACC 2012, 60: 531-538
**WATCHMAN™ LAAC - Device Overview**

### Nitinol Frame
- Radially expands to maintain position in LAA
- Available sizes:
  - 21, 24, 27, 30, 33 mm (diameter)
- 10 Active fixation anchors around device perimeter engage LAA tissue for stability and retention
- Contour shape accommodates most LAA anatomies

### 160 Micron Membrane
- Polyethylene terephthalate (PET) cap
- Designed to block emboli from exiting the LAA
- Intended to promote healing process
PROTECT AF 4 Year Follow Up: Primary Efficacy Endpoint

<table>
<thead>
<tr>
<th>Event</th>
<th>Watchman Group (n = 463)</th>
<th>Warfarin Group (n = 244)</th>
<th>Rate Ratio (Watchman/Warfarin) (95% Crl)</th>
<th>Posterior Probabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Events/Patient-Years</td>
<td>Events</td>
<td>Observed Rate (Events per 100 Patient-Years) (95% Crl)</td>
<td>Events/Patient-Years</td>
<td>Observed Rate (Events per 100 Patient-Years) (95% Crl)</td>
</tr>
<tr>
<td>Primary Efficacy Endpoint</td>
<td>39/1720.2</td>
<td>2.3 (1.7, 3.2)</td>
<td>34/900.8</td>
<td>3.8 (2.5, 4.9)</td>
</tr>
</tbody>
</table>
Events in PROTECT AF trial at 2,621 patient years

**Primary Efficacy**
- Watchman Group: 2.3 events per 100 patient years
- Warfarin Group: 3.8 events per 100 patient years
- 40% lower
- $P_s = 0.96$

**CV or Unexplained Death**
- Watchman Group: 1.0 event per 100 patient years
- Warfarin Group: 2.4 events per 100 patient years
- 60% lower
- $P = 0.0045$

**All-Cause Death**
- Watchman Group: 3.2 events per 100 patient years
- Warfarin Group: 4.8 events per 100 patient years
- 34% lower
- $P = 0.0379$

Ps = Posterior Probability for Superiority

**All three endpoints met statistical superiority**
• FINAL INDICATION

• The WATCHMAN Device is indicated to reduce the risk of thromboembolism from the left atrial appendage in patients with non-valvular atrial fibrillation who:
  • Are at increased risk for stroke and systemic embolism based on CHADS\textsubscript{2} or CHA\textsubscript{2}DS\textsubscript{2}-VASc scores and are recommended for anticoagulation therapy;
  • Are deemed by their physicians to be suitable for warfarin; and
  • Have an appropriate rationale to seek a non-pharmacologic alternative to warfarin, taking into account the safety and effectiveness of the device compared to warfarin.
ATRIAL FIBRILLATION
WELLNESS PROGRAM
# Risk Factors for Atrial Fibrillation

<table>
<thead>
<tr>
<th>Diabetes</th>
<th>1.4/1.6</th>
</tr>
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<tbody>
<tr>
<td>Benjamin et al.</td>
<td>9</td>
</tr>
<tr>
<td>Furberg et al.</td>
<td>11</td>
</tr>
<tr>
<td>Gammage et al.</td>
<td>20</td>
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<tr>
<td>Marcus et al.</td>
<td>18</td>
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<tr>
<td>Chamberlain et al.</td>
<td>19</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Coronary artery disease (MI)</th>
<th>1.4/4</th>
</tr>
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<tbody>
<tr>
<td>Benjamin et al.</td>
<td>9</td>
</tr>
<tr>
<td>Furberg et al.</td>
<td>11</td>
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<tr>
<td>Krahn et al.</td>
<td>21</td>
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<tr>
<td>Psaty et al.</td>
<td>12</td>
</tr>
<tr>
<td>Gami et al.</td>
<td>4</td>
</tr>
<tr>
<td>Gammage et al.</td>
<td>20</td>
</tr>
<tr>
<td>Aviles et al.</td>
<td>17</td>
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<tr>
<td>Marcus et al.</td>
<td>18</td>
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<tr>
<td>Chamberlain et al.</td>
<td>19</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sleep apnoea syndrome</th>
<th>3.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stevenson et al.</td>
<td>38</td>
</tr>
<tr>
<td>Gami et al.</td>
<td>16</td>
</tr>
<tr>
<td>only &lt;65 years</td>
<td>3.3</td>
</tr>
<tr>
<td>Gami et al.</td>
<td>39</td>
</tr>
<tr>
<td>2.2</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Subclinical hyperthyroidism</th>
<th>3.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sawin et al.</td>
<td>40</td>
</tr>
<tr>
<td>(relative risk)</td>
<td></td>
</tr>
<tr>
<td>Gammage et al.</td>
<td>20</td>
</tr>
<tr>
<td>Cappola et al.</td>
<td>41</td>
</tr>
<tr>
<td>Heeringa et al.</td>
<td>42</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Alcohol consumption (often excessive)</th>
<th>1.9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conen et al.</td>
<td>43</td>
</tr>
<tr>
<td>Rosenregen et al.</td>
<td>22</td>
</tr>
<tr>
<td>Mukamal et al.</td>
<td>44</td>
</tr>
<tr>
<td>former</td>
<td>1.3</td>
</tr>
<tr>
<td>Kadoma et al.</td>
<td></td>
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<thead>
<tr>
<th>Chronic kidney disease</th>
<th>1.9</th>
</tr>
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<tbody>
<tr>
<td>Iguchi et al.</td>
<td>45</td>
</tr>
<tr>
<td>Baber et al.</td>
<td>46</td>
</tr>
<tr>
<td>Asselbergs et al.</td>
<td>47</td>
</tr>
<tr>
<td>albuminuria</td>
<td>1.5</td>
</tr>
<tr>
<td>Go et al.</td>
<td>48</td>
</tr>
<tr>
<td>1.9</td>
<td></td>
</tr>
<tr>
<td>Horio et al.</td>
<td>49</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Competitive or athlete-level endurance sports</th>
<th>1.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mont et al.</td>
<td>37</td>
</tr>
<tr>
<td>Abdulla et al.</td>
<td>50</td>
</tr>
<tr>
<td>meta-an</td>
<td>5.3</td>
</tr>
<tr>
<td>Aizer et al.</td>
<td>51</td>
</tr>
<tr>
<td>5—7 days/week</td>
<td>1.7</td>
</tr>
<tr>
<td>Molina et al.</td>
<td>52</td>
</tr>
<tr>
<td>8.8</td>
<td></td>
</tr>
<tr>
<td>Elouza et al.</td>
<td>53</td>
</tr>
<tr>
<td>2.9</td>
<td></td>
</tr>
</tbody>
</table>
AF: Recognizing the Continuum

- AF begets AF
- Ionic and structural remodeling

Corsi et al Europace 2010
Effect of Yoga on Arrhythmia Burden, Anxiety, Depression, and Quality of Life in Paroxysmal Atrial Fibrillation

The YOGA My Heart Study

Dhanunjaya Lakkireddy, MD,* Donita Atkins, RN,* Jayasree Pillarisetti, MD,* Kay Ryschon, MS,† Sudharani Bommana, MPhil,* Jeanne Drisko, MD,‡ Subbareddy Vanga, MBBS, MS.§ Buddhadeb Dawn, MD*

Kansas City, Kansas; Omaha, Nebraska; and Newark, Delaware
Aggressive Risk Factor Reduction Study for Atrial Fibrillation and Implications for the Outcome of Ablation: The ARREST-AF Cohort Study

Effect of Obstructive Sleep Apnea Treatment on Atrial Fibrillation Recurrence: A Meta-Analysis

Ashish Shukla, MD, MPH, Anthony Aizer, MD, MSc, Douglas Holmes, MD, Steven Fowler, MD, David S. Park, MD, PhD, Scott Bernstein, MD, Neil Bernstein, MD, Larry Chinitz, MD

**FIGURE 2** Forest Plot to Compare AF Recurrence in Users Versus Nonusers of CPAP In Patients With OSA

<table>
<thead>
<tr>
<th>Study</th>
<th>Year</th>
<th>RR (95% CI)</th>
<th>Treatment</th>
<th>Control</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kanagala et al</td>
<td>2003</td>
<td>0.51 (0.26, 1.02)</td>
<td>5/12</td>
<td>22/27</td>
<td>4.43</td>
</tr>
<tr>
<td>Jongnarangsin et al</td>
<td>2008</td>
<td>0.70 (0.40, 1.24)</td>
<td>9/18</td>
<td>10/14</td>
<td>3.68</td>
</tr>
<tr>
<td>Patel et al</td>
<td>2010</td>
<td>0.61 (0.51, 0.73)</td>
<td>105/315</td>
<td>178/325</td>
<td>57.34</td>
</tr>
<tr>
<td>Bazan et al</td>
<td>2013</td>
<td>0.66 (0.33, 1.34)</td>
<td>8/27</td>
<td>13/29</td>
<td>4.10</td>
</tr>
<tr>
<td>Fein et al</td>
<td>2013</td>
<td>0.44 (0.24, 0.82)</td>
<td>9/32</td>
<td>19/30</td>
<td>6.42</td>
</tr>
<tr>
<td>Naruse et al</td>
<td>2013</td>
<td>0.58 (0.37, 0.91)</td>
<td>25/82</td>
<td>18/34</td>
<td>8.33</td>
</tr>
<tr>
<td>Neilan et al</td>
<td>2013</td>
<td>0.52 (0.37, 0.74)</td>
<td>25/71</td>
<td>48/71</td>
<td>15.71</td>
</tr>
<tr>
<td>Overall</td>
<td></td>
<td>0.58 (0.51, 0.67)</td>
<td>186/557</td>
<td>308/530</td>
<td>100.00</td>
</tr>
</tbody>
</table>
Patient Related

Solutions

Awareness
- Brochures
- Patient App

Risk Factors
- Sleep Apnea
  - Automatic Sleep Study prior to ablation
- Weight Loss
  - Cardiac Rehab Peroperatively

Yoga - Quarterly Free/cheap Yoga sessions
- Nutrition - Meet Nutritionist once pre/post ablation
- Meditation - Quarterly Free/Cheap Sessions
Atrial Fibrillation (AFib) is an abnormal heart rhythm characterized by a rapid and irregular heart beat. Risk factors include high blood pressure, sleep apnea, obesity, poor diet and exercise habits, smoking and heart disease. The Atrial Fibrillation Wellness Program is a unique approach to disease management that combines the latest technology and cutting-edge procedures with a strong focus on lifestyle modification to prevent and decrease the burden of AFib.

With a particularly high rate of AFib in the South Coast region, the Atrial Fibrillation Wellness Program seeks to educate patients and the local physician community on the prevention and management of this disorder. This comprehensive program is designed to help identify high-risk patients and streamline their access to care, offering the tools to help reduce the risk for AFib through education, exercise and lifestyle changes, and social supports.

Our Doctors

- Ramin Davoudi MD, Medical Director
  Arrhythmia Services, Southcoast Health System

- Nitosh Sood MD, Director
  Atrial Fibrillation Wellness Program
  Staff Electrophysiologist, Southcoast Health System

- Arnoldas Giedrimas MD
  Staff Electrophysiologist
  Southcoast Health System
Questions