MRI Based Analysis in Atrial Fibrillation

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AF Prevalence is increasing rapidly

Atrial Fibrillation and Mortality

With atrial fibrillation | Without atrial fibrillation

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Men 65 to 74 yrs</th>
<th>Men 75 to 84 yrs</th>
<th>Men 85 to 89 yrs</th>
<th>Women 65 to 74 yrs</th>
<th>Women 75 to 84 yrs</th>
<th>Women 85 to 89 yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>38.6</td>
<td>54.5</td>
<td>71.3</td>
<td>30.2*</td>
<td>47.4*</td>
<td>65.1*</td>
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<tr>
<td></td>
<td>34.0</td>
<td>47.5</td>
<td>62.4</td>
<td>25.4*</td>
<td>36.1*</td>
<td>62.4</td>
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<tr>
<td></td>
<td>25.4*</td>
<td>36.1*</td>
<td>51.0*</td>
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* Significantly different from patients with atrial fibrillation (P<0.05).

Thromboembolism

• 5-fold ↑ in risk of stroke\(^1\)
• >20% of strokes in the US are attributable to AF
• Incidence of all-cause stroke in patients with AF: 5%\(^1\)

Total Annual Costs of AF

Total costs: 14.65 billion dollars

- Hospitalization: 55%
- Inpatient costs: 20%
- Outpatient costs: 13%
- Prescription drugs: 10%
- Stroke related costs: 2%

Treatment of Atrial Fibrillation With Radiofrequency Ablation: Systematic Literature Reviews and Meta-Analyses

- Single Procedure Success Off AAD: 56.5%
- Multiple Procedure Success Off AAD: 71%
- Single Procedure Success On or Off Medication: 73%
- Multiple Procedure Success On or Off Medication: 77%
- Patients Requiring Repeat Ablation: 26%

Calkins a et al Circ A&E 2009
Scientific Goals

Use MRI to improve management of AF

- Personalize treatment options
  - Ablation vs drugs
- Real time MRI guided RF ablation
- Post ablation evaluation
DE-MRI based quantification of atrial fibrosis in patients with AF

Staging AF

Personalize treatment options
ECG based diagnosis of Atrial fibrillation

Patient I

Patient II

Patient III

Patient IV
DE-MRI based Staging of AF
Quantification of atrial fibrosis

Early stage

Stage II

Stage III

Stage IV

Afib/Marrouche
Structural Changes and Ablation Outcome

Stage I
Stage II
Stage III
Stage IV

Recurrence by Pre-Ablation Delayed Enhancement

Proportion of Patients in Sinus Rhythm

Days since Ablation

<5% SRM
5-20% SRM
20-35% SRM
>35% SRM

Akoum et al. AHA 2009
LA structural remodeling (fibrosis) detected using DE-MRI and risk of stroke

(Logistic Regression Controlling for CHF, Age>75 yo, HTN and DM)
Future Role of Center

Pre-ablation staging
  • Quantification of tissue remodeling
  • Automated segmentation of atria/enhancement
  • Improvement in staging scoring

Real time MRI guided RF ablation
  • Automated segmentation/creation of anatomical models
  • Visualization of anatomy and lesion formation
  • Motion compensation for navigation support

Post-ablation evaluation
  • Complete characterization of ablation scar and link to recurrence and outcome
  • Differentiate scar from structural remodeling
  • Quantify shape changes in atrial structure – develop new clinical indices of progression of recovery from ablation
  • Integrated, multimodal visualization of atria