Imaging Based Analysis of Patients with Atrial Fibrillation

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What is Atrial Fibrillation?
= Afib = AF
Background I

John C Grammer MD FACC
Atrial Fibrillation Illustrated

ATRIAL FLUTTER
WITH
3:1 CONDUCTION
Normal Contraction

Atrial Fibrillation
AF Prevalence

Projected Number of Persons With AF (millions)

Year

Current age-adjusted AF incidence
Increased age-adjusted AF incidence

20% of Strokes

$20 billion/year
The CARMA Mantra

“AF is a heart tissue disease”

Normal  Early stage  Mid stage  Late stage

Ausma J, .... Allessie M ...J mol Cell Cardiol. 2001: 2083.
Structure Matters
Late Gadolinium Enhancement

Pre-treatment 3 month Post
Utah Scoring Scheme: 2011

Utah Score Predicts Outcome

![Recurrence Free Proportion vs. Follow up (days) graph showing different stages of SRM (Utah I, Utah II, Utah III, Utah IV) and their recurrence rates with log rank test p < 0.01.](image)
MRI & Fibrosis: Blue is Normal

Chris McGann

Amit Patel

epi
endo
MRI & Fibrosis: Green is Fibrosis

endo

epi
Histology Summary

Control

AF-mix

AF-fibrosis
Fibrosis Analysis
What Role Does Image Segmentation Play?
The CARMA AF Workflow
Automated Segmentation

- GA Tech: Segmentation of the Endocardial Wall of the Left Atrium using Local Region-Based Active Contours and Statistical Shape Learning, Gholami, et al., 2010
Workflow Past
The New Workflow
Corview in Action
Corview in Action
Role of Shape Analysis in AF
Registration

Greg Gardner
Koji Higuchi
Alan Morris
Josh Cates
Simulation: What Causes AFib?
Substrate + Trigger
Substrate: Fibrosis

Complex Propagation

de Groot, .... Allessie MA. Circ. 2010: 1674-1682.
Substrate: Extension of muscle sleeves
Triggers

Left Atrium

Pulmonary Veins
Clinical Result

Normal conduction

Atrial fibrillation

SA Node

Normal electrical signals

Disorganized electrical signals
Patient Specific Models of AF

Josh Blauer

Natalia Trayanova

Kathleen McDowell
Segmentation

Seg3D 2.0
Goal: Identifying Structures
Segmentation in the Real World

Say No To Manual Labor!

Important things* are handcrafted
* things that matter

UTAH BEER
WE MAY LIVE IN A DESERT, BUT WE'RE NOT DRY
Seg3D - 3D Segmentation

Seg3D 2.0

www.seg3d.org
Seg3D: Introduction

Seg3D 2.1

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Seg3D: In Action
Seg3D: Layers
Seg3D: Measurements
Seg3D: Volume Visualization
Seg3D: Provenance