A COMPARATIVE STUDY OF CRYOBALLOON, RADIOFREQUENCY, AND LASER ABLATIONS FOR THE TREATMENT OF ATRIAL FIBRILLATION

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Western Michigan University
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OUTLINE

• What is heart disease?
• Atrial Fibrillation Introduction
• Current Treatments for Atrial Fibrillation
• Introduction to Ablation Techniques
• Research Aims
• Methods of Study
• Conclusions
• Future Implications
What is Heart Disease - America's Number 1 Killer

The Plumbing of the Heart

- Typically associated with myocardial infarctions (heart attacks), bypass grafting, stenting, etc.
- Each can be classified under Coronary Artery Disease
- This is the “plumbing” of the heart

The Electrical Signaling

- Arrhythmia: Disruption in the heart’s electrical circuit
- The “electrical” of the heart
- Ventricular tachycardia, premature ventricular contractions, supraventricular tachycardia, and atrial fibrillation (AF)
• Blood is pumped from the atria to the ventricles
• Pumping is stimulated by the electrical circuit
• AF originates in the pulmonary veins
• This disrupts proper pumping action
• Atria fibrillate

Why is this a problem?
• AF is not deadly
• Complications
• Symptoms can be debilitating or deadly
ATRIAL FIBRILLATION

Debilitating Symptoms
- Palpitations
- Fatigue/Lethargy
- Dizziness
- Tachycardia (RVR)
- Anxiety

Stroke Risk
- The left atrium fibrillates, causing the blood to pool and coagulate
- Stroke is a large risk associated with atrial fibrillation
- First step when diagnosed with AF is assess need for anticoagulation
CURRENT TREATMENTS

Treatment progresses from most conservative to most invasive

1. Medications
   - Anticoagulation
   - Beta Blockers
   - Anti Arrhythmic

2. Cardioversion

3. Intervention
   - Surgical- Cox Maze
   - AV node ablation and Pacemaker implantation
   - Pulmonary vein isolation/ Ablation
ABLATIONS

Three Explored in this Study

• Cryoballoon (CB) Ablation
• Radiofrequency (RF) Ablation
• Laser (LA) Ablation

1. Catheter inserted into a vein in the groin
2. Travels up through the vein to the right atrium
3. Punctured into left atrium
4. Cauterizes tissue around pulmonary veins
CRYOBALLOON ABLATION

- Freezes
- Delivers spherical burn
- Not fit for all anatomy
• Burning radiation
• Single point burn
• Fit for all/most anatomy
• Used in first time and re-do ablations
LASER ABLATION

- Burning radiation
- Adjustable balloon
- Uses real-time camera imaging to view the atrium as it is being ablated
RESEARCH AIMS

• To compile one cohesive study comparing Laser, Cryoballoon, and Radiofrequency ablation techniques

• To suggest which techniques have the highest efficacy and/or lowest incidence of complications
METHODS

• 4 major studies selected
  • Discussed with Electrophysiologist

• Not all studies encompassed data on all techniques, but at least one and at least one the highlighted risks/recurrence data

• Risks Explored in this study: Thromboembolic events (TE), groin hematoma, major bleeding, and phrenic nerve paralysis

• Compiled into one cohesive document
### RESULTS

<table>
<thead>
<tr>
<th>Technique versus Study</th>
<th>Orange Study</th>
<th>Green Study</th>
<th>Blue Study</th>
<th>Yellow Study</th>
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- **Orange/Green/Blue/Yellow studies**
- Does show number of patients in this table
- **Green and Blue discussed LA solely**
- **Yellow discussed CB and RF**
### RESULTS

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<tr>
<th>Raw Data</th>
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- Expressed as a percentage of total subjects
Studies that both included a report on a risk/recurrence listed were averaged
• PNP risk is less than 5% for each technique
  • 9 patients CB
  • 1 RF
  • 10 LA

• LA had the highest, then CB, then RF

• All cases resolved with patient regaining function of PN either peri-operatively or post-operatively

• Perhaps technique dependent
RESULTS

- Each Study exhibited incidence in less than 1% of patients
  - CB: 0.32%
  - RF: 0.27%
  - LA: 0% (0.0084%)
- Perhaps technique dependent
• Both hematoma and major bleeding fall under “bleeding”

• RF had highest major bleeding, but lowest GH

• Results suggest that bleeding is not technique dependent
• **Purpose of Ablation** is to have long-term/lifelong results

• **Why assume the risk** if there is not a promising outcome?

• All data collected after 3 month blanking period

• LA had lowest recurrence, then CB, then RF
CONCLUSIONS

• Each technique has its own advantages and disadvantages

• Bleeding did not suggest any one technique being superior to another

• Thromboembolic events were clearly less frequent in laser ablations, though rates were consistently below 1%

• Phrenic nerve paralysis was least frequent in radiofrequency ablations

• Recurrence was least prevalent with laser ablations

• Suggests that the circumstances of each patient should be thoroughly explored before deciding on technique, however laser ablation may offer the best chance at a lifelong cure
• While informational, this study was limited. In the future the study could be repeated for primary data at one institution.

• Laser ablation is an up-and-coming technique and hospitals who perform AF ablations should consider implementing LA technology.
REFERENCES


ACKNOWLEDGEMENTS

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Dr. John Jellies
Dr. Wassim Jawad, M.D.
Lee Honors College
Troy deHagen
THANK YOU!
Yellow Study:

Green Study:

Blue Study:

Orange Study: