



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

Amanda Croft

Chair: Dr. John Spitsbergen

Committee Member: Dr. John Jellies

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**Western Michigan University
Lee Honors College**



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

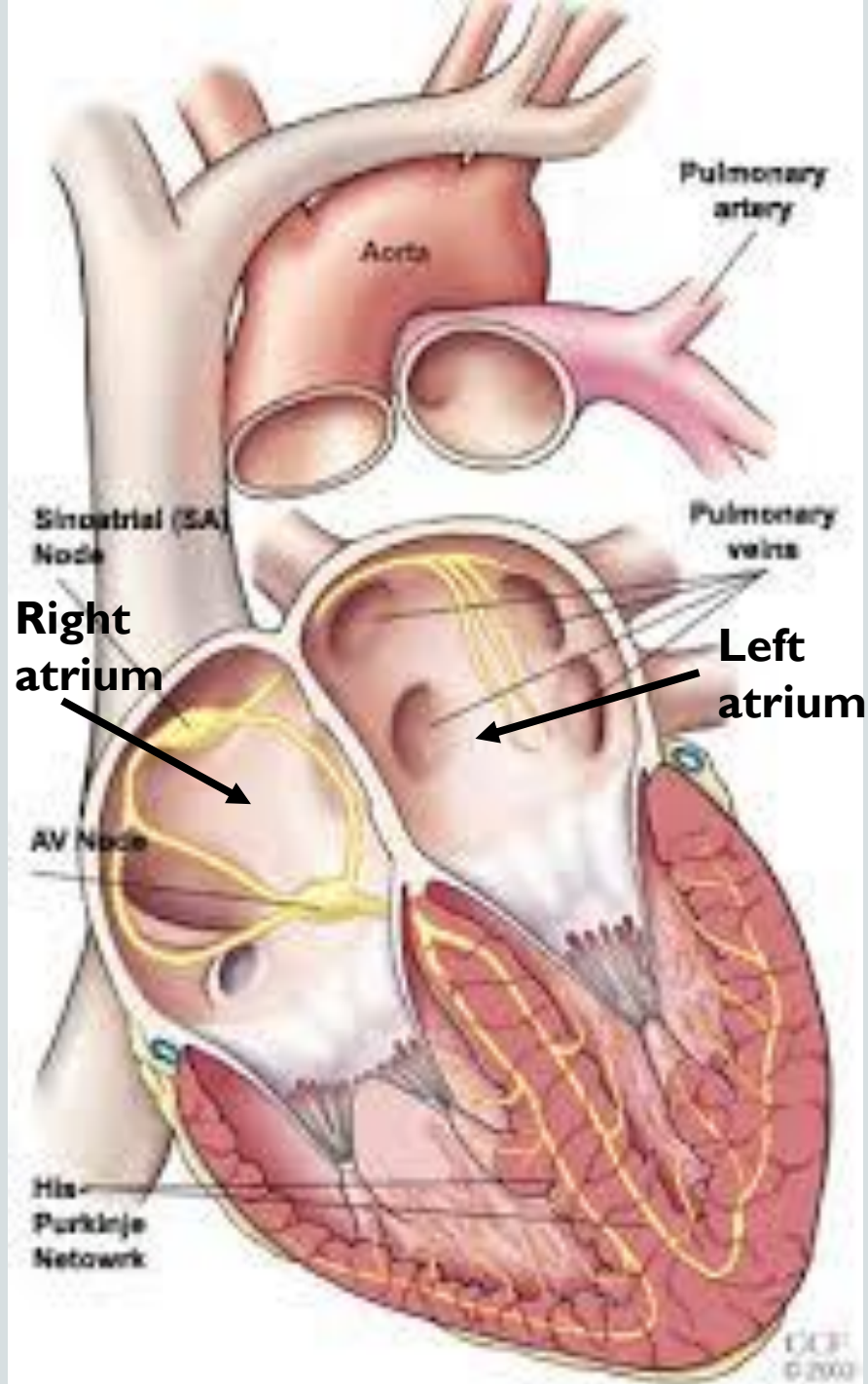
The Plumbing of the Heart

- 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**



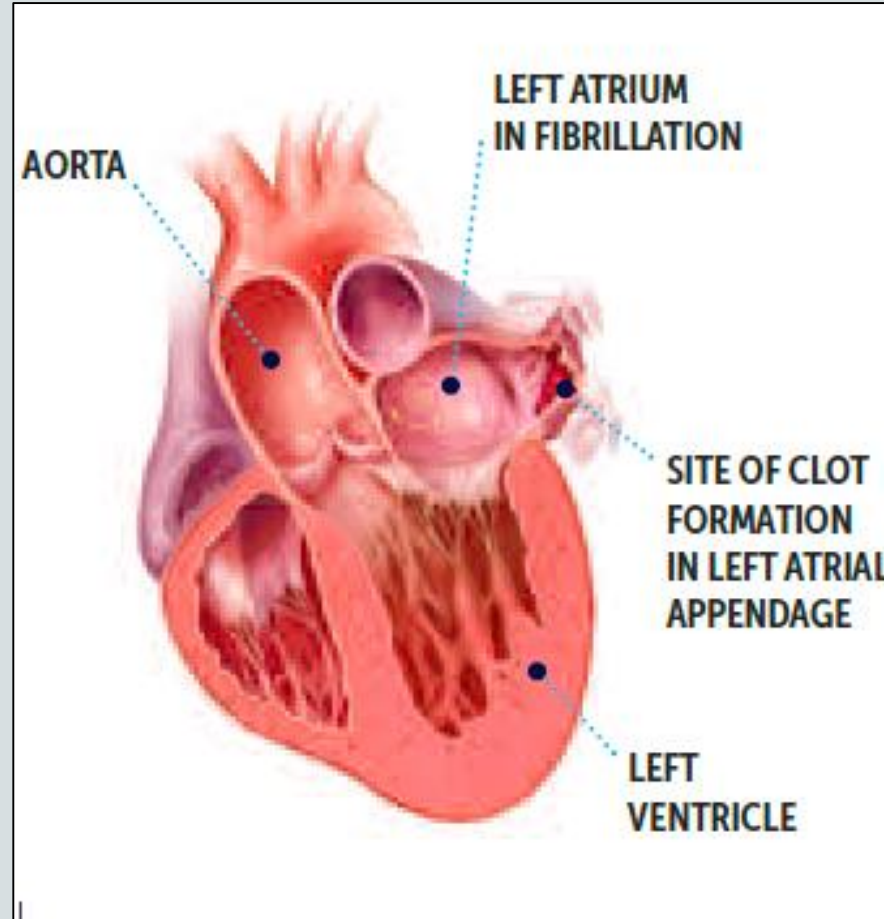
Why is this a problem?

- **AF is not deadly**
- **Complications**
- **Symptoms can be debilitating or deadly**

ATRIAL FIBRILLATION

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



Debilitating Symptoms

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

CURRENT TREATMENTS

Treatment progresses from most conservative to most invasive

I. Medications



- Anticoagulation
- Beta Blockers
- Anti Arrhythmic

2. Cardioversion

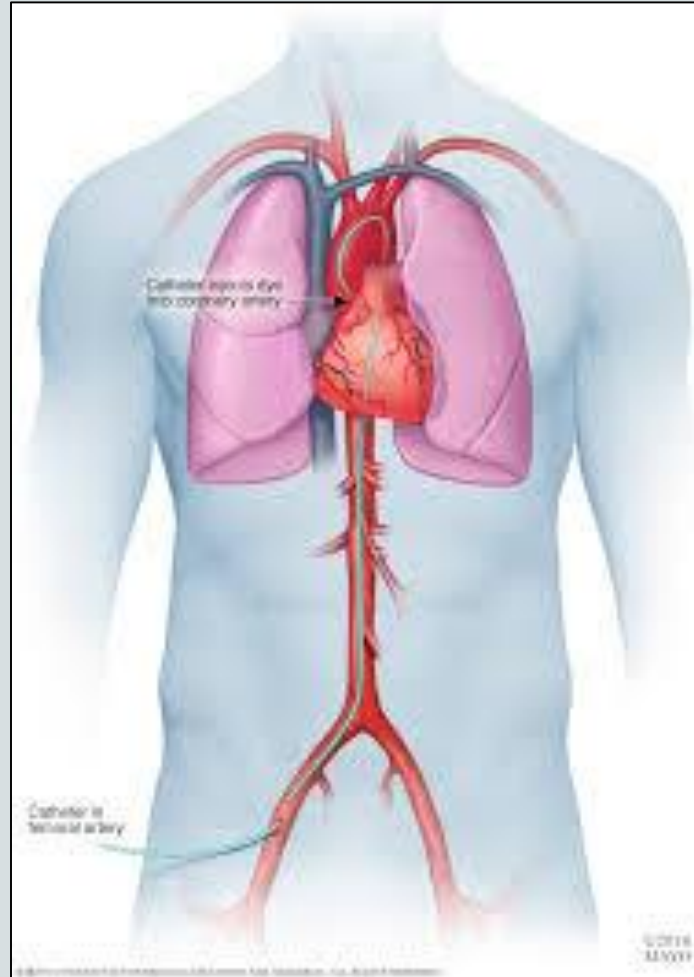


3. Intervention

- Surgical- Cox Maze
- AV node ablation and Pacemaker implantation
- Pulmonary vein isolation/ Ablation

ABLATIONS

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**

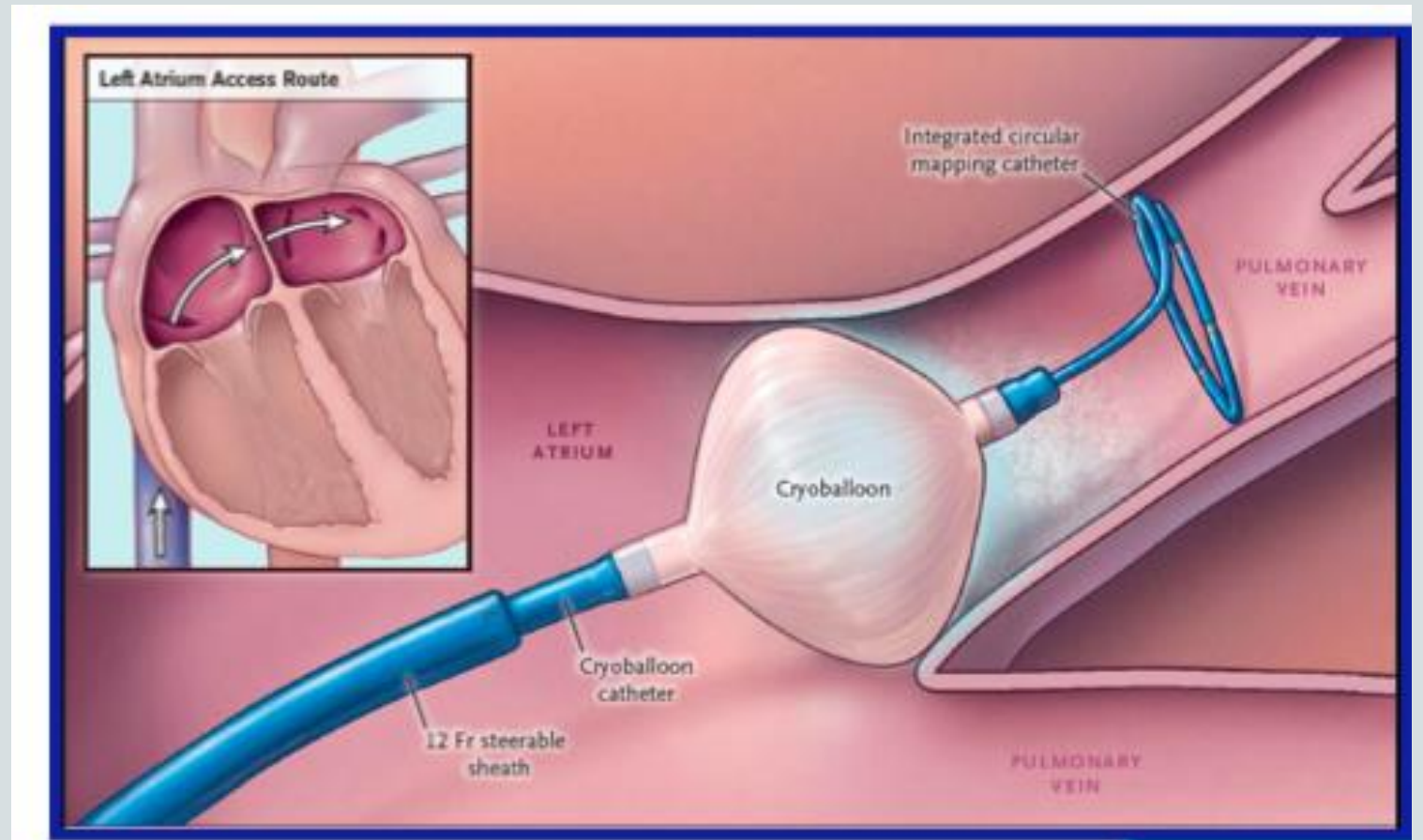


Three Explored in this Study

- **Cryoballoon (CB) Ablation**
- **Radiofrequency (RF) Ablation**
- **Laser (LA) Ablation**

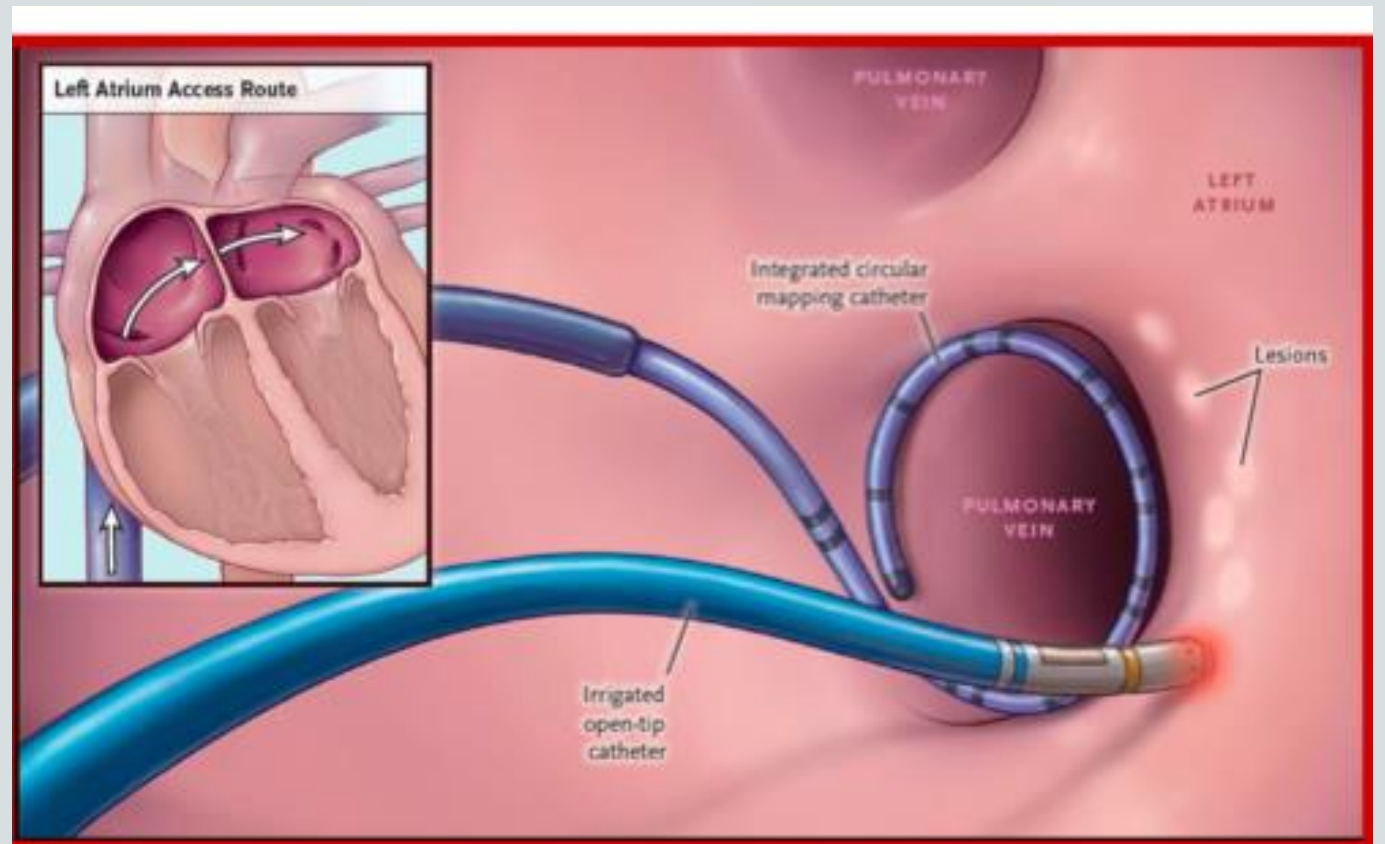
CRYOBALLOON ABLATION

- Freezes
- Delivers spherical burn
- Not fit for all anatomy



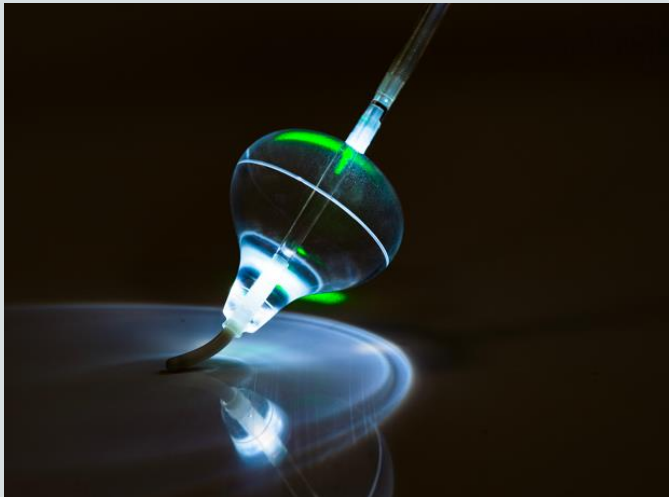
RADIOFREQUENCY

- **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

- **Orange/Green/Blue/Yellow studies**
- **Does show number of patients in this table**
- **Green and Blue discussed LA solely**
- **Yellow discussed CB and RF**

Technique versus Study	Orange Study	Green Study	Blue Study	Yellow Study
Cryoballoon				
# of Patients	311.00			50.00
Recurrence at 10 months	86.00			
Recurrence at 1 year				27.00
Thromboembolic event	1.00			
Groin hematoma				2.00
Major bleeding	7.00			
Phrenic nerve Paralysis	7.00			2.00
Radiofrequency				
# of Patients	376.00			56.00
Recurrence at 10 months	171.00			
Recurrence at 1 year				19.00
Thromboembolic event	1.00			
Groin hematoma				1.00
Major bleeding	12.00			
Phrenic nerve Paralysis	1.00			0.00
Laser				
# of Patients		167.00	71.00	
Recurrence at 10 months				
Recurrence at 1 year		61.00		
Thromboembolic event		2.00	0.00	
Groin hematoma			3.00	
Major bleeding		0.00	1.00	
Phrenic nerve Paralysis		6.00	4.00	

RESULTS

- Expressed as a percentage of total subjects

Raw Data	Orange Study	Green Study	Blue Study	Yellow Study
Cryoballoon				
Recurrence at 10 months	27.65			
Recurrence at 1 year				54.00
Thromboembolic event	0.32			
Groin hematoma				4.00
Major bleeding	2.25			
Phrenic nerve Paralysis	2.25			4.00
RF				
Recurrence at 10 months	45.48			
Recurrence at 1 year				66.07
Thromboembolic event	0.27			
Groin hematoma				1.79
Major bleeding	3.19			
Phrenic nerve Paralysis	0.27			0.00
Laser				
Recurrence at 10 months				
Recurrence at 1 year		36.53		
Thromboembolic event		1.20	0.00	
Groin hematoma			4.23	
Major bleeding		0.00	1.41	
Phrenic nerve Paralysis		3.59	5.63	

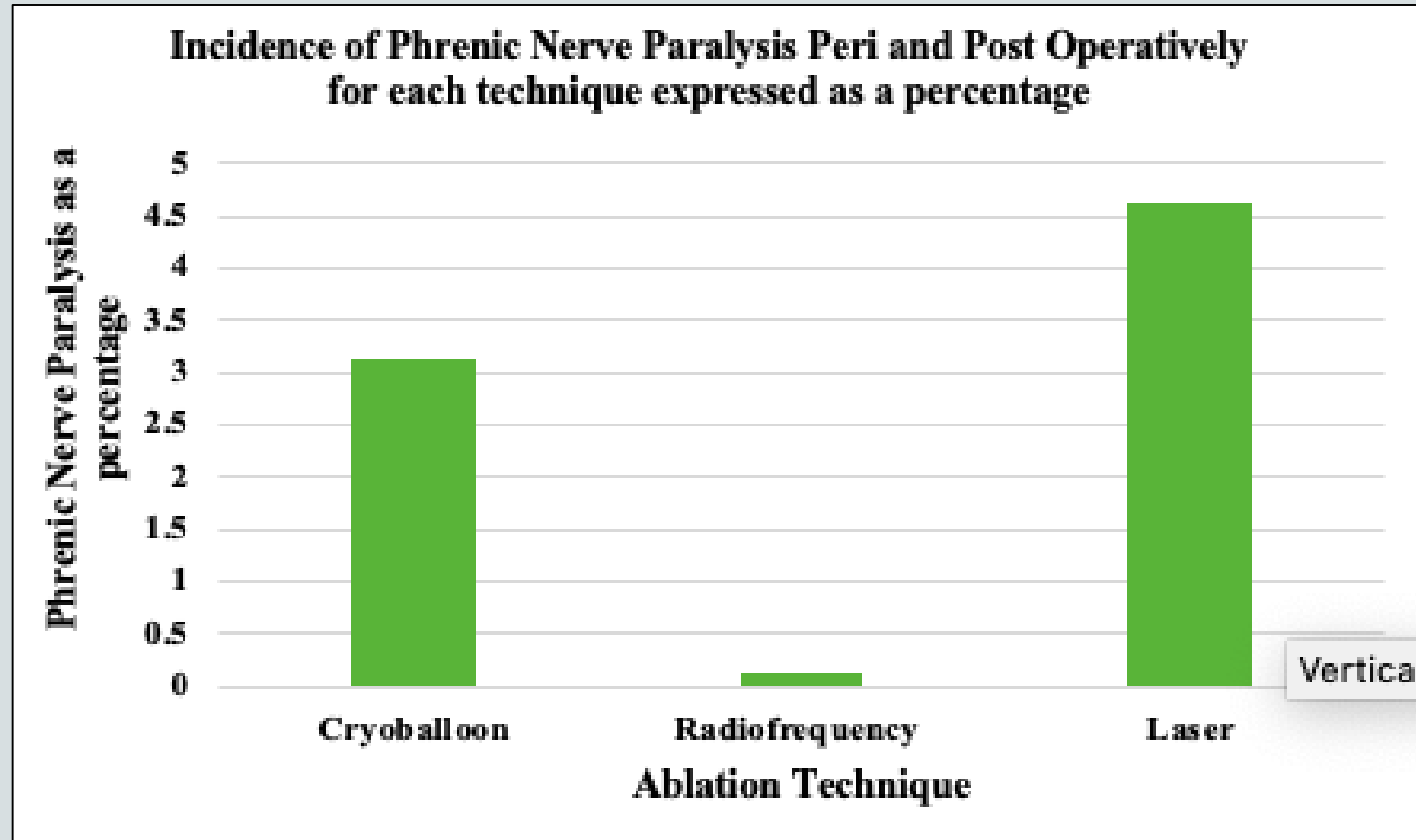
RESULTS

Comparative CA v. RF v. LA	Cryoballoon	Radiofrequency	Laser
Recurrence at 12 months	54.00	66.07	36.53
Thromboembolic event	0.32	0.27	0.00
Groin hematoma	4.00	1.79	4.23
Major bleeding	2.25	3.19	1.41
Phrenic nerve Paralysis	3.13	0.14	4.62

- **Studies that both included a report on a risk/recurrence listed were averaged**

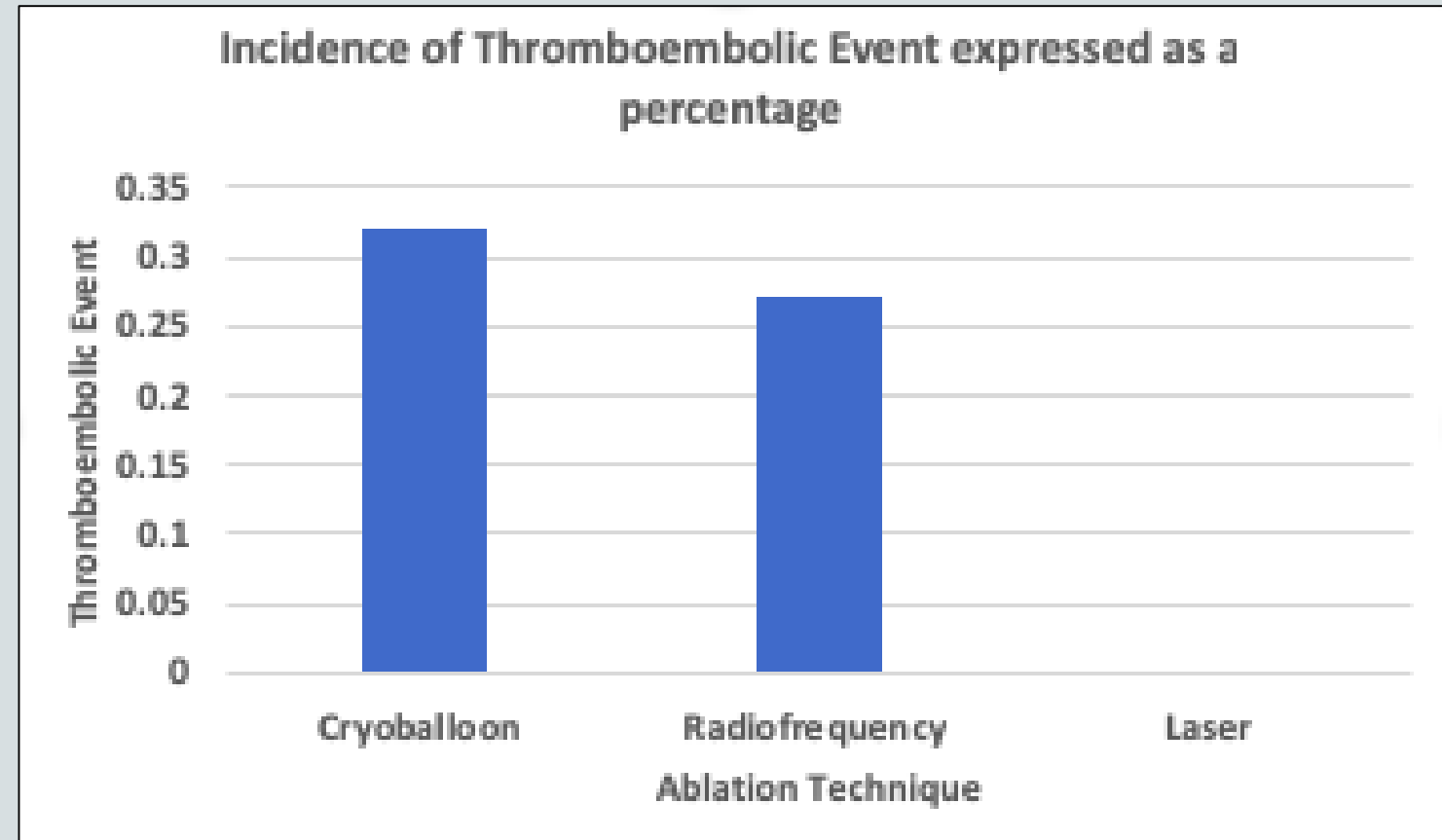
RESULTS

- **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**



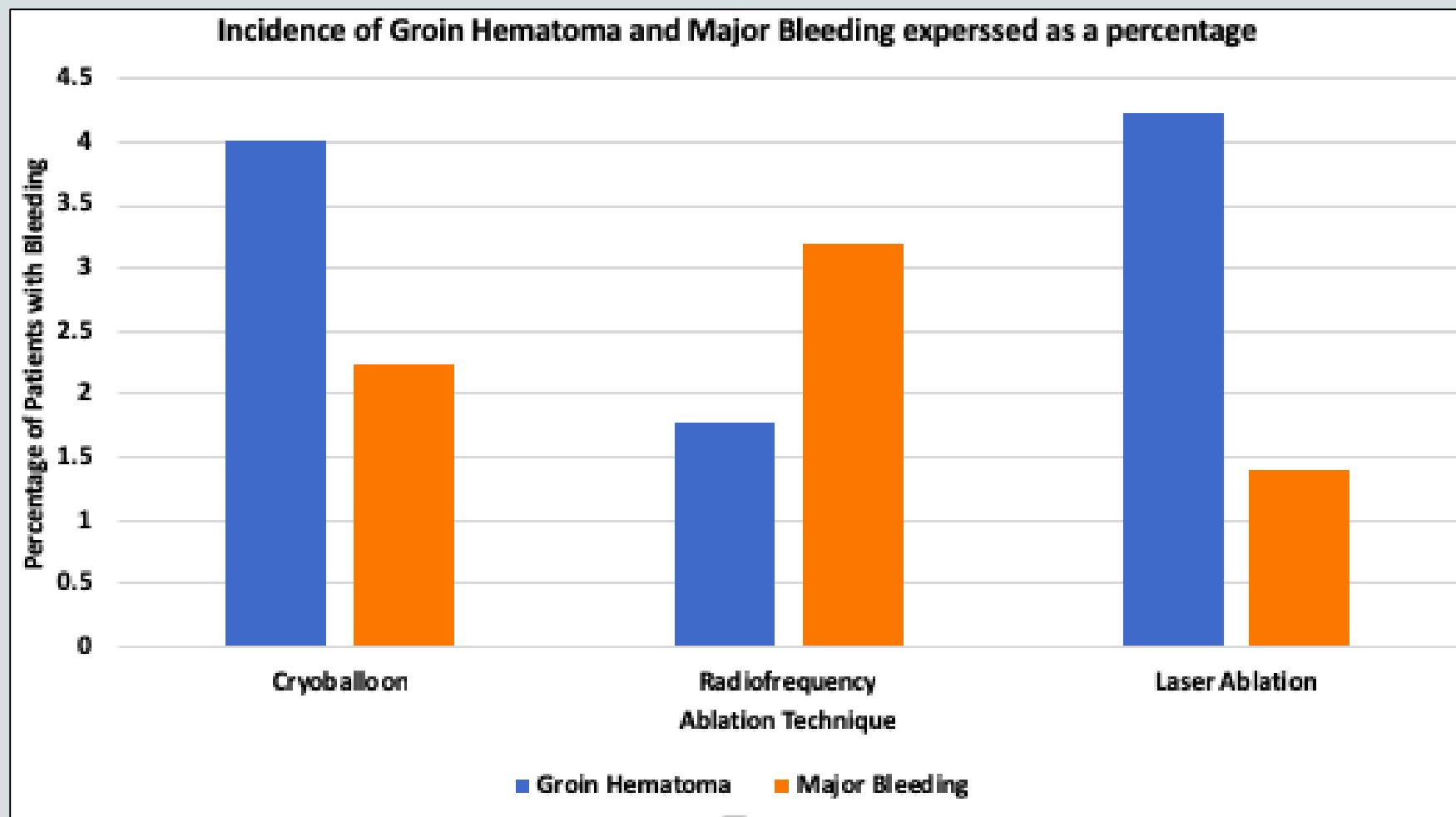
RESULTS

- **Each Study exhibited incidence in less than 1% of patients**
 - **CB: 0.32%**
 - **RF: 0.27%**
 - **LA: 0% (0.0084%)**
- **Perhaps technique dependent**



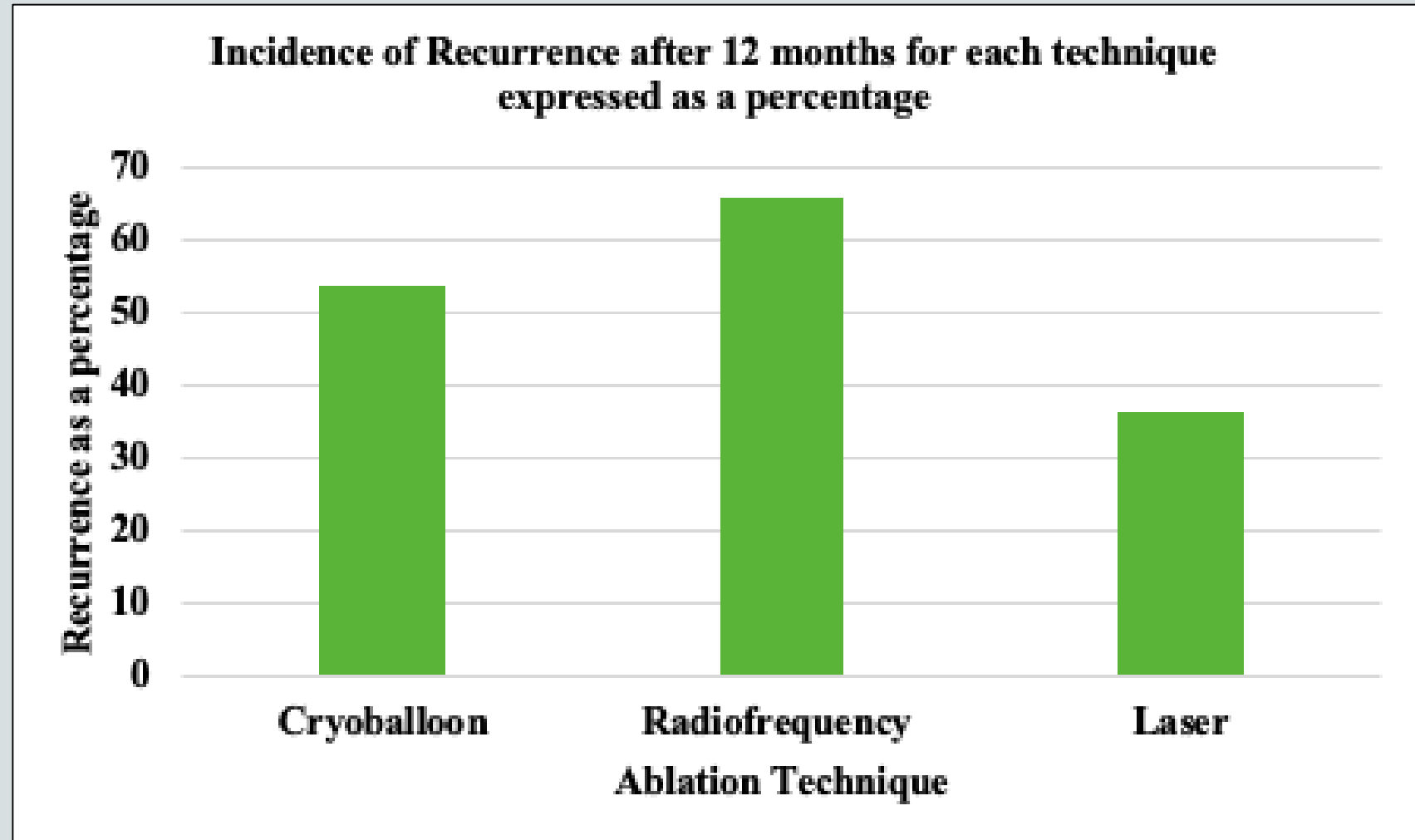
RESULTS

- Both hematoma and major bleeding fall under “bleeding”
- RF had highest major bleeding, but lowest GH
- Results suggest that bleeding is not technique dependent



RESULTS

- **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**

LOOKING TO THE FUTURE

- **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**

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Troy deHagen

A 3D wireframe heart is the central focus, rendered with a gradient from red at the top to blue at the bottom. It is set against a blue background with a white grid pattern. A white ECG line is visible on the right side of the image. The text "THANK YOU!" is centered in the middle of the image.

THANK YOU!

Yellow Study:

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Blue Study:

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Orange Study:

Khoueiry, Z., Albenque, J. P., Providencia, R., Combes, S., Combes, N., Jourda, F., . . . Boveda, S. (2016). Outcomes after cryoablation vs. radiofrequency in patients with paroxysmal atrial fibrillation: impact of pulmonary veins anatomy. *Europace*, 1343-1351.