Obstructive Sleep Apnea and its Cardiac Effects

In Collaboration with

Dr. Brian Panama

at

Masonic Medical Research Laboratory

Jacob Lux
Contents

- Background on obstructive sleep apnea (OSA)
- Mechanics of OSA
- Proteins
- Methods and materials
- Results
- Interpreting results & conclusion
What is Obstructive Sleep Apnea (OSA)?
What is Obstructive Sleep Apnea (OSA)?
Who and what does OSA affect?

• Overweight, middle-aged adults
• Neuromuscular disorders
• 4% of men, 2% of women
• Hereditary tendency
• Prevalence increases as age and weight increases
• Fatigue due to low quality sleep

OSA and the Cardiovascular System

Congestive Heart Failure
OSA and the Cardiovascular System

- 5-fold increase in atrial dysrhythmias
- 2-fold increase in congestive heart failure (CHF)
- High Blood Pressure
- Decreased intrathoracic pressure
OSA and the Cardiovascular System (Cont.)
OSA and the Cardiovascular System (Cont.)

11. https://www.youtube.com/watch?v=6bGndBjus8M
OSA and the Cardiovascular System (Cont.)

Hypothesis

- Rats will be exposed to simulated acute OSA
- Cardiac levels of TNFα and Col1a2 will be increased
  - Most likely due to decreased intrathoracic pressure and heart stretching
Experimental Methods

- Tracheal obstruction device surgically implanted
- Computerized air system
- 60 13-second sleep apneas an hour
- 8 hours a day, 5 days a week
- 2 weeks
Evidence of Apnea

![Graph showing O2 Saturation over time](image_url)

Tumor Necrosis Factor Alpha (TNFα)

• Pro-inflammatory
• Stimulates fibrosis and formation of mesenchymal tissue
• Initiates cardiac inflammation in high concentrations.
• Inhibits cardiac contractility
• May lead to CHF

Collagen Type 1 α 2 (Col1a2)

- Component of type 1 collagen (21)
- Cartilage, bone, tendon, skin, and the white part of the eye (22)

(21) http://ghr.nlm.nih.gov/gene/COL1A2
(22) http://compbio.cs.princeton.edu/csc/collagen_molecule.jpg
mRNA and What It Does
Measurement of Gene Activity

• Removed hearts from experimental & control rats
• Homogenize hearts
• Process mRNA using kit
• mRNA quantification

Indirectly measures protein levels
Results

Results

Protein Upregulation

mRNA Relative Expression (fold change)

Col1a2

Control

2 week apnea
Conclusion

• Increased fibrotic expression (Col1a2)
• Increased inflammatory expression (TNF)
• Hypothesis supported
• Shows DNA expression, not protein production or function.
Where to Go from Here

• Proteomics
• Optical mapping
• Histological analysis
• Cardiac catheterization
• Patch clamping experiments
• Invasive pacing and ECG monitoring
Thank you

Special thanks to:

Dr. Brian Panama, Meredith McLerie, and David Durgan (Baylor College of Medicine)

Masonic Medical Research Laboratory

The Free and Accepted Masons of New York State

The Grand Chapter of New York State

And

Dr. Melissa Barlett
 Works Cited


11. https://www.youtube.com/watch?v=8BiGnd8ju8M

12. http://rsf.royalsocietypublishing.org/content/1/1/101


17. http://watchlearnlive.heart.org/CVM_1_Player.php?moduleSelect=atrfib


