

Abstract

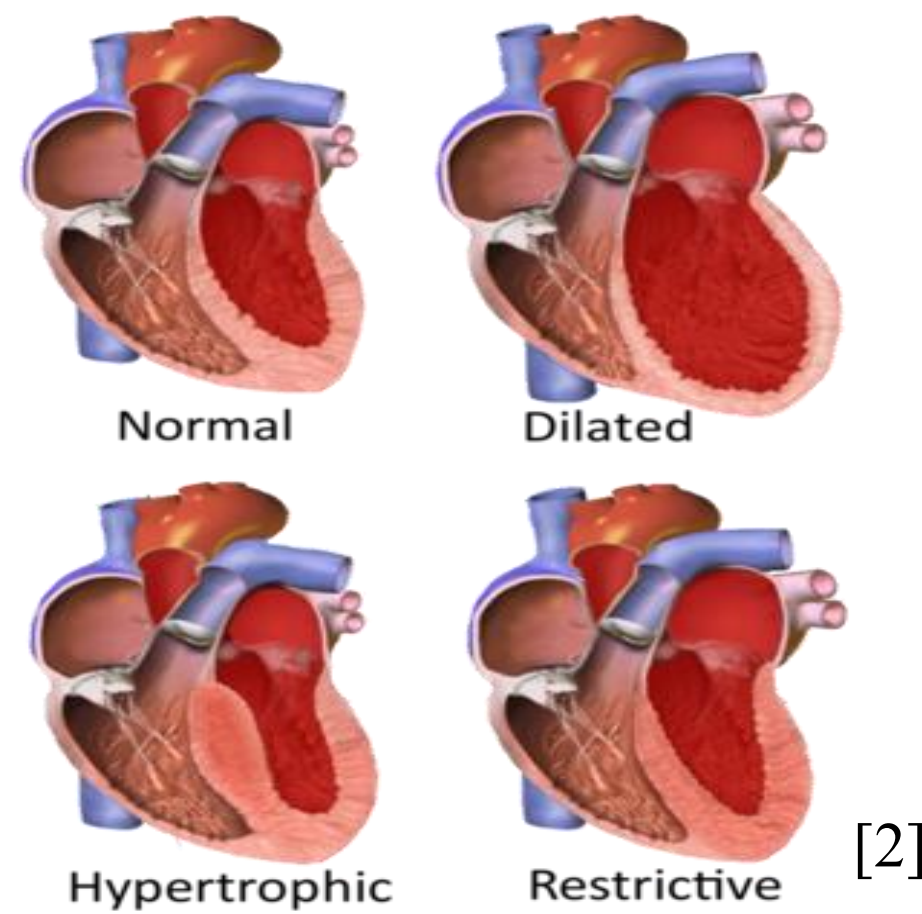
The goal of this project was to process the results from phase-contrast MRI into a format that can be used in a flow reconstruction procedure. The first step was to create a mesh of the left ventricle using the data, followed by identifying the mitral and aortic valves. The displacement of the wall of the ventricle between time steps was then determined. Once all these steps were performed, the velocity data was filtered and reconstructed easily using methods previously developed in the Shadden Lab.

Introduction

- Heart disease is the leading cause of death in the United States, accounting for one in every four deaths. [1]

Example of heart disease:

- Size and shape of ventricles provides information about heart disease, but doesn't always provide the full picture of the disease state.



Imaging of ventricles is easier than imaging of blood flow. Then, why is blood flow very important to image?

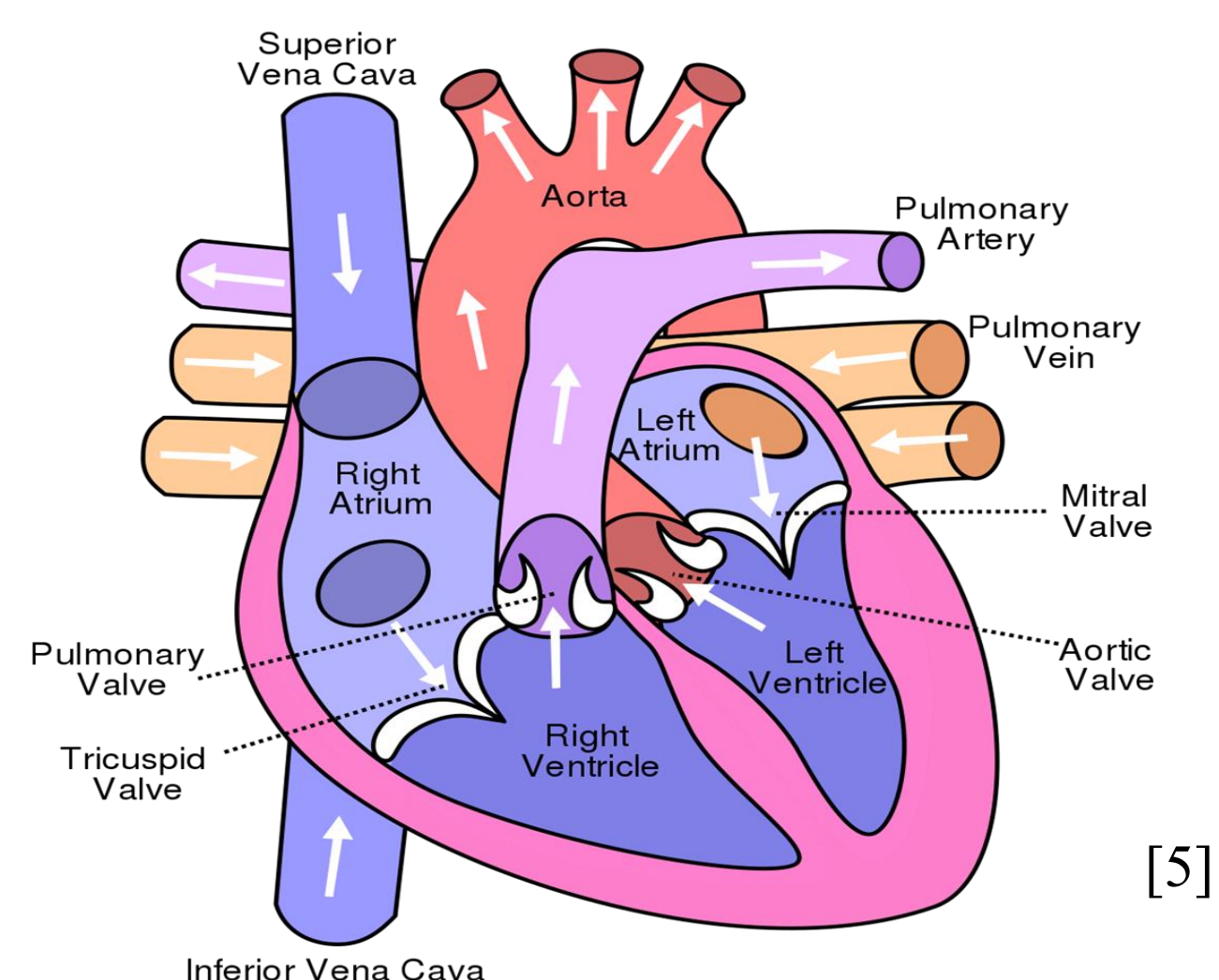
- There is evidence that blood flow changes before the walls of the ventricles change. [3]
- Improved flow imaging has the potential to show changes that are contributing to heart failure. [4]

Goal

- Phase-contrast MRI is the gold standard for three-dimensional imaging of blood flow. However, the collected data is noisy.

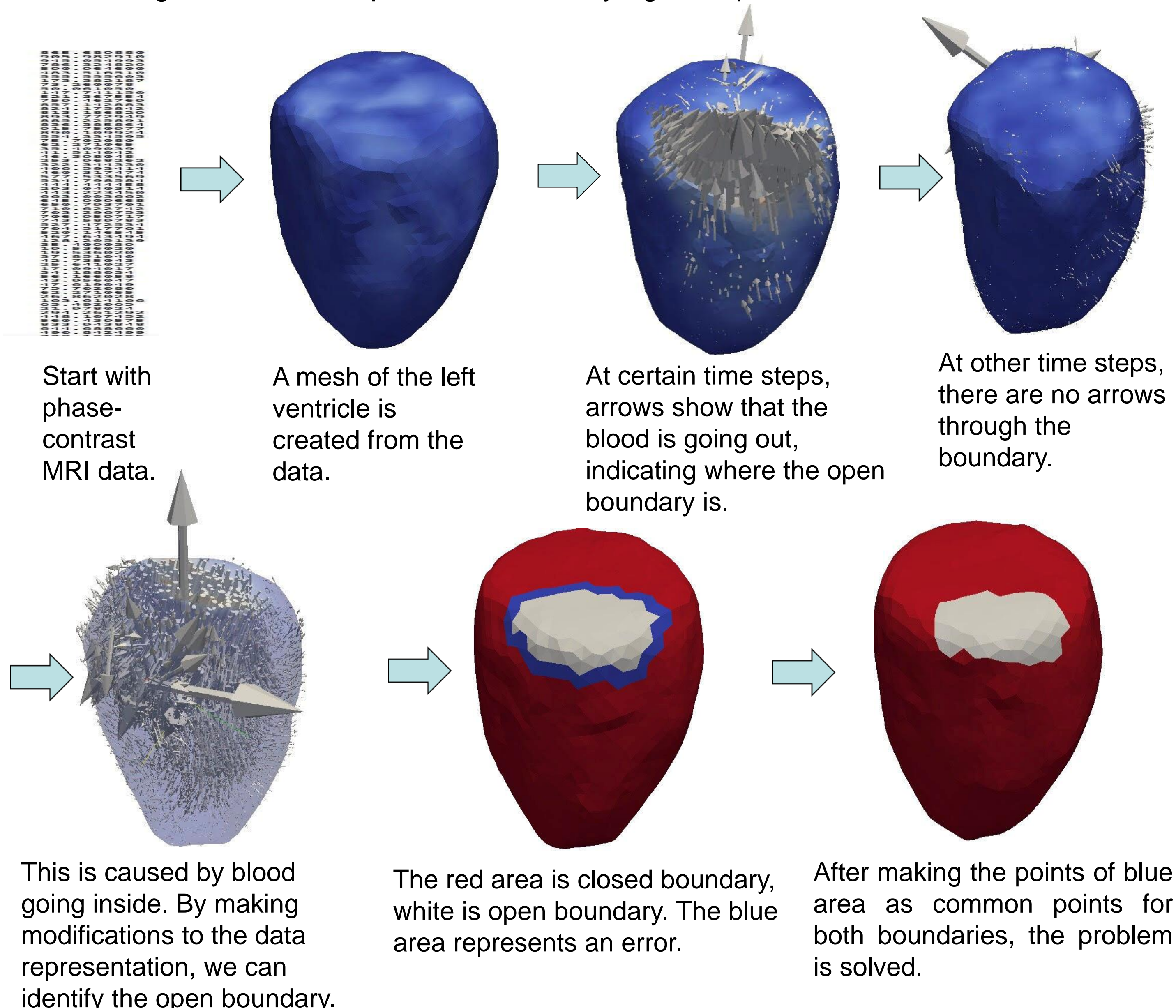
- ❖ The goal of this project was to process the results from phase-contrast MRI to a format that can be used to reduce the noise.

- For this particular reconstruction method, the mitral and aortic valves needed to be identified. When the valves are open, meaning that they are allowing flow into and out of the left ventricle, they are considered an open boundary and the rest of the walls are a closed boundary.



Methods

- These figures show the process of identifying the open and closed boundaries



Results

- After locating the open and closed boundaries, the data was reconstructed using a previously developed Shadden Lab program.

Before Reconstruction



After Reconstruction



- After processing, the noise in the image has decreased.

Future Work

- In the reconstruction method, it was assumed that blood flow on the boundary is perpendicular to the surface, which is not correct. In the future, the reconstruction method will be modified to avoid this assumption.

Before Reconstruction



After Reconstruction



- More alternative markings of the boundary and meshes will continue to be tested to improve the result of the reconstruction.

Conclusion

- This is one step in improving understanding of healthy and diseased conditions of blood flow in the heart.
- As a better understanding of disease and disease progression is achieved, people will be able to receive treatment at earlier stages of the disease, improving their prognosis.

Acknowledgement

I would like to thank my mentor, Sarah Frank, for helping me throughout the research. I also want to thank Professor Shawn Shadden, for giving me the opportunity to be a part of his lab group. Thank you, Lea and Kimberley, for organizing the TTE REU program and for your help throughout the program.

References

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Support Information

This work was funded by National Science Foundation Award EEC 1461157

