



COMPARISON OF LEFT ATRIAL SHAPE BETWEEN THE SEXES WITH ATRIAL FIBRILLATION

Andie Sieja (Faculty Mentor: Rob MacLeod PhD)
Department of Biomedical Engineering

Introduction: Atrial fibrillation (AF) affects between 2.7 and 6.1 million people in the United States [1]. AF is a cardiac arrhythmia that interrupts the organized electrical and mechanical function of the atria. Previous studies have documented a range of differences in symptom severity and treatment outcomes between men and women with AF [1]-[8]. Some studies argue that women have reduced procedural success, while others argue there is no difference in outcome between the sexes. These studies also suggested that differences in outcomes between sexes could be related to shape differences in the left atrium (LA) [1]-[8]. Current literature supports the notion that female atria are, on average, smaller than male atria [2], [6]. However, overall size of the LA is not the only possible feature of possibly relevant differences in shape between the sexes. The goal of this study was to determine shape differences of the LA between the sexes using sophisticated statistical shape analysis.

Methods: We analyzed magnetic resonance imaging (MRI) scans to identify the left atrium from 447 patients. The 447 scans were divided into groups of 200 female and 247 male AF patients. We performed shape analysis on these scans using ShapeWorks, an open-source tool for statistical shape analysis [9]. From the resulting shape models, we were able to reconstruct and compare mean left atrial shapes between the two groups.

Results: The most significant mode of variation between the sexes was overall size of the atria, with the mean LA of the women being ~1-2 millimeters smaller than the mean LA of the men (Figure 1). In addition to overall size, the mean LA shapes of the male and female subjects varied in three specific areas. There were shape differences where the left atrium meets the mitral valve, shown at the bottom of the LA, where it appears to come to a rounded end (Figure 1). Variation was also seen in the attachment site of the pulmonary veins, which appear on either side of the LA, seen on the top left of the anterior view colored in red and the upper yellow section on the posterior view. Finally, variation was seen in the region where the left atrial appendage meets the body of the atrium. The left atrial appendage is the branching structure seen in the green and blue section on the top right of the anterior view and the top left of the posterior view.

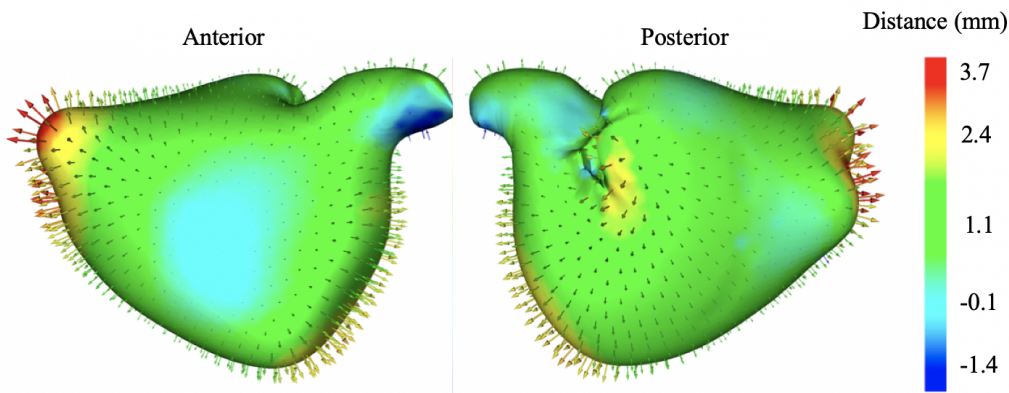


Fig. 1 Difference of LA shape between sexes. The LA is viewed from the anterior (left) and posterior (right) view. The difference map shows how the female LA mean would have to change to become the male LA mean. The vector directions represent a positive or negative change in distance. The color bar represents distance changed in millimeters.

Discussion: Our results support hypotheses of LA shape differences between the sexes, although the differences are relatively small. The results show an overall size difference between the two sexes, which supports current literature values and was expected [2], [6]. The differences seen in the pulmonary veins, left atrial appendage, and mitral valve sites are novel and could have functional consequences to the disease and ablation therapy. A limitation of all such studies is the potential for segmentation bias because the MRI scans were manually segmented by different individuals. The resulting variations could contribute to the observed shape differences. Future work to investigate the LA shape differences between the sexes could include outcome results and comorbidity matching because most individuals with AF tend to be affected by other diseases as well. These additional groups with outside diseases would allow us to determine if the shape differences seen are solely due to AF or if other diseases play a factor in the variations.

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