

ATRIAL FIBRILLATION: MULTI-DETECTOR CT EVALUATION OF LEFT ATRIAL MORPHOLOGY

Atrial fibrillation is one of the most common cardiac arrhythmias and its etiology is not clearly understood. It has been associated with the enlargement of the left atrium, but a direct correlation between the atrium and pulmonary venous morphological characteristics has not been investigated. Our objective was to determine if morphological characteristics of the left atrium and pulmonary venous connections are associated with atrial fibrillation.

Left atrial and pulmonary venous anatomies were assessed using cardiac CT scans of 30 atrial fibrillation patients and 30 normal controls. The following measures were recorded: ratio of widest over narrowest pulmonary venous ostia diameters; number and area of pulmonary venous ostia; angles of insertion of the left and right pulmonary venous connections to the left atrium; left atrial volume; interostial area; and coronary sinus diameter.

Atrial fibrillation patients showed significantly larger: left atrial volume; interostial area; pulmonary venous ostial area; and coronary sinus diameter when compared to the controls. No significant differences were seen in: pulmonary venous ostia ratios; frequency of a separate right middle lobe or a superior segment of the right lower lobe ostia. Pulmonary venous angle insertions between both groups was approximately equal.

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BACKGROUND

Atrial fibrillation is one of the most common cardiac arrhythmias and results in abnormal heart rhythms.¹ In a normal heart, the electrical impulse is generated by the sinoatrial node located in the right atrium which signals the other chambers in the heart to contract in a certain order to attain maximum efficiency in blood oxygenation and to pump blood out to the rest of the body. In atrial fibrillation an electrical impulse can originate from almost anywhere in the heart or pulmonary veins instead of at the sinoatrial node, causing the heart to receive several electrical impulses from various parts of the heart.² As a result, the heart's blood-pumping efficiency is greatly decreased because the chambers of the heart are contracting from various electrical signals throughout the heart instead of the one signal from the sinoatrial node. From previous studies, atrial fibrillation has been associated with the enlargement of the left atrium, but a correlation between the atrium and pulmonary venous morphological characteristics has not been investigated.³ Our objective was to determine if morphological characteristics of the left atrium and pulmonary venous connections are associated with atrial fibrillation.

METHODS

Contrast-enhanced multi-detector cardiac CT scans were examined in 30 atrial fibrillation patient cases and 30 normal controls. The observer recorded the following for both groups; left atrial volume, ratio of pulmonary venous ostia, number and area of pulmonary

venous ostia, angles of insertion of the left and right pulmonary venous connections to the left atrium, interostial area, and the coronary sinus diameter. The left atrial volume was determined by the summation of the atrial area in contiguous slices of the chamber. The ratio of pulmonary venous ostia was determined by the widest over the narrowest pulmonary venous diameters. The angles of insertion of the pulmonary venous connections to the left atrium were determined by measuring the angle of lines traced parallel to the long axis of the right upper lobe, the right lower lobe, the left upper lobe, and the left lower lobe.

Since all parameters presented normal Gaussian distribution, a Student *t* test was used for the comparison of continuous variables between both groups. In addition, a chi-square test was used for the comparison of categorical variables. A multiple regression analysis was performed controlling for the presence of coronary artery disease and hypertension history. It was established that a *P* value of < 0.05 was statistically significant.

RESULTS

The atrial fibrillation patient cases showed significantly larger left atrial volume, larger interostial area, larger pulmonary venous ostia, and larger coronary sinus diameter when compared to the normal controls. The ratios of pulmonary venous widest and narrowest diameters ranged from 1.0 to 1.7. Our measurements showed that only the left superior pulmonary vein was elliptical in shape in both the case and control groups. However, no sig-

nificant size difference was seen for the pulmonary venous ostia ratios or the pulmonary venous angle insertions between the patients and the controls.

Variants in the anatomy of pulmonary venous connections to the left atrium were identified in both groups. The frequency of a separate right middle lobe ($P=0.49$) and a superior segment of the right lower lobe ($P=0.69$) pulmonary venous ostia was not significantly different between the study groups.

CONCLUSION

Atrial fibrillation patients presented larger left atrial volume, larger pulmonary venous ostial area, larger interostial area, and larger coronary sinus diameter when compared to controls. No differences were found in shapes and angles of venous connections. Given the cross-sectional design of the study, the cause-effect relationship cannot be evaluated.

REFERENCES

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