Prevalence and Characterization of Pulmonary Vein Variants in Patients with Atrial Fibrillation Determined using Multislice Computed Tomography

Thesis

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DEDICATION

To my kind father, loving mother

To my lovely wife/ Reem

To my kids Nadia, Ahmed and Mohamed

To my brother /Ahmed

And to my sisters.

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List of Abbreviations

Abbreviation	Meaning
AF	Atrial Fibrillation
APs	Action Potentials
ArPVs	Arrhythmogenic Pulmonary Veins
AV	Atrioventricular
CAF	Chronic Atrial Fibrillation
CHF	Congestive Heart Failure
CT	Computed Tomography
DADs	Delayed After Depolarizations
EAD	Early After Depolarization
ECG	Electrocardiogram
ERP	Effective Refractory Period
LA	Left Atrium
LAA	Left Atrial Appendage
LA-PV	Left Atrial–Pulmonary Vein
LIPV	Left Inferior Pulmonary Vein
LIPV	Left Inferior Pulmonary Vein
LNG	Lingual
LSPV	Left Superior Pulmonary Vein
LVEF	Left Ventricular Ejection Fraction
MDCT	Multidetector Row CT

NE	Norepinephrine
PAF	Paroxysmal Atrial Fibrillation
PVs	Pulmonary Veins
RA	Right Atrial
RCTs	Randomized Clinical Trials
RFA	Radiofrequency Ablation
RFCA	Radiofrequency Catheter Ablation
RIPV	Right Inferior Pulmonary Vein
RLL	Right Lower Lobe
RML	Right Middle Lobe
RSPV	Right Superior Pulmonary Vein
RUL	Right Upper Lobe
SMC	Smooth Muscle Cell
SVC	Superior Vena Cava
TEE	Transesophageal echocardiography

PROTOCOL

Introduction

Recent advances in multislice computed tomography (CT) has enabled us to visualize the pulmonary veins (PVs) and left atrium (LA) non invasively by creating high-quality 3 – dimensional images. **(Ueda et al., 2005)**

Conventional PV anatomy was defined as the presence of single right and left superior and inferior PVs that drained into the LA without accessory veins. **(Schwartzman et al., 2003)**

A common PV trunk , defined as a PV with coalescence of superior and inferior PVs >1.5 cm proximal to the junction with the left atrium. **(Micochova et al., 2005)**

Supernumerary or accessory PVs were defined as extra veins with independent atriopulmonary venous junctions separate from the superior and inferior PVs. **(Lacomis et al., 2003)**

A middle PV was defined as a distinct vein branching from the left atrial body and was clearly separated from the superior and inferior PV ostia. **(Lacomis et al., 2003)**

A right top PV was defined as an anomalous insertion of a branch of the right superior PV into the left atrial body. **(Lickfett et al., 2004)**

The PV ostium was the atriopulmonary venous junction. in epicardial views , it was identified as the point of the reflection of the parietal pericardium from the left atrium. **(Ueda et al., 2005)**

Kaseno et al., 2008 performed a study in the USA, where multislice CT was performed in 428 patients who had atrial fibrillation, size and branching pattern of PVs were analyzed.

A Typical pattern of 4 PVs with 4 separate ostia was found in 326 patients (76%).

A common PV trunk , was found on→

a) Left side in 34 patients (8%)

b) Right side in 3 patients (0.7%)

A discrete middle PV was found on →

a) Right side in 54 patients (13%)

b) Left side in 9 patients (2%)

A right top PV was also found in 16 patients (4%).

In conclusion, 24 % of studied patients with atrial fibrillation had PV anomalies and 3 % had coexistence of 2 PV variants , indicating that PV variants are not rare. (Am J cardiol 2008 ; 101 : 1638-1642).

Aim of the work

To analyze the anatomical pattern of pulmonary veins in patients who have atrial fibrillation.

Patients and methods

This is a cross sectional study which will include 200 subjects , 100 consecutive patients who have Atrial fibrillation and another 100 normal control subjects retrospectively chosen among patients who already underwent multislice CT for coronary angiography .

Inclusion criteria:

- Patients aging between 20& 65 years old.
- Patients with paroxysmal, persistent or permanent AF.
- Patients with either normal heart or structural heart disease.

Exclusion criteria:

- Patients who have renal impairment that contraindicates injection of contrast material.
- Patients with heart rate above 70 beats per minute in the control group during the scan.
- Patients who are not able to hold their breath during the scan.

All patients will be subjected to →

1) History taking especially symptoms of AF, AF duration and medications that patient receives.
2) Brief clinical examination
3) 12 lead ECG (resting & during AF)
4) Echocardiography (especially left atrial size)
5) All patients will be screened for renal functions:

- No patients with serum creatinine >1.5mg% will be included in the study.
- Patients with creatinine between 0.1-1.5 will be admitted for hydration and acetyl cysteine therapy before the procedures.

6) Multislice computed tomography of pulmonary veins.

After informed written consent is obtained , images will be acquired using a multislice computed tomographic scanner during an intravenous injection of contrast dye (75ml at 5ml/s) in 64 parallel slices (1.25mm collimation), in 0.5 mm thickness.

The branching pattern of PVs and size of PVs and left atrium will be analyzed (number of veins, range prevalence of variants %) .

In all patients, quantitative measurement of PVs and their variants and the left atrium will be performed using electronic 3-dimensional digital calipers.

Osteal diameters of PVs and their variants will be measured in 3 – dimensional reconstructed epicardial or endoscopic images.

Statistical analysis :

The statistical analysis will be performed using the appropriate statistical method.