Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/IPEJ

Change in P wave morphology after convergent atrial fibrillation ablation

Suvash Shrestha [a], *On Chen* [b], *Mary Greene* [b], *Jinu Jacob John* [b,c], *Yisachar Greenberg* [d], *Felix Yang* [d,*]

[a] *Department of Internal Medicine, Maimonides Medical Center, Brooklyn, NY, USA*
[b] *Department of Cardiology, Maimonides Medical Center, Brooklyn, NY, USA*
[c] *William Beaumont Hospital, Royal Oak, MI, USA*
[d] *Department of Cardiac-electrophysiology, Maimonides Medical Center, Brooklyn, NY, USA*

ARTICLE INFO

Article history:
Available online 12 February 2016

Keywords:
Convergent ablation
Atrial fibrillation
P wave area
P wave duration

ABSTRACT

Convergent atrial fibrillation ablation involves extensive epicardial as well as endocardial ablation of the left atrium. We examined whether it changes the morphology of the surface P wave. We reviewed electrocardiograms of 29 patients who underwent convergent ablation for atrial fibrillation. In leads V_1, II and III, we measured P wave duration, area and amplitude before ablation, and at 1, 3 and 6 months from ablation.

After ablation, there were no significant changes in P wave amplitude, area, or duration in leads II and III. There was a significant reduction in the area of the terminal negative deflection of the P wave in V_1 from 0.38 mm^2 to 0.13 mm^2 ($p = 0.03$). There is also an acute increase in the amplitude and duration of the positive component of the P wave in V_1 followed by a reduction in both by 6 months. Before ablation, 62.5% of the patients had biphasic P waves in V_1. In 6 months, only 39.2% of them had biphasic P waves.

Hybrid ablation causes a reduction of the terminal negative deflection of the P wave in V_1 as well as temporal changes in the duration and amplitude of the positive component of the P wave in V_1. This likely reflects the reduced electrical contribution of the posterior left atrium after ablation as well as anatomical and autonomic remodeling. Recognition of this altered sinus P wave morphology is useful in the diagnosis of atrial arrhythmias in this patient population.

Introduction

Atrial fibrillation (AF) is a common form of supraventricular tachyarrythmia affecting more than 5 million people in the US alone [1]. Current understanding suggests that AF results from anatomic substrate capable of both initiation and perpetuation of fibrillatory waves [2,3]. Most of these foci are found at the orifices of pulmonary veins and the posterior atrial wall [4]. Thus, ablation of these foci has emerged as the treatment

* Corresponding author. Department of Cardiology, Division of Cardiac Electrophysiology, Maimonides Medical Center, 4802 10th Avenue, Brooklyn, NY 11219, USA. Tel.: +1 718 282 1443; fax: +1 718 282 1706.
E-mail addresses: sshrestha@maimonidesmed.org, suvashsht@gmail.com (S. Shrestha), ochen@maimonidesmed.org (O. Chen), MAgreene@maimonidesmed.org (M. Greene), Jjohn3@maimonidesmed.org, jinu.john@beaumont.edu (J.J. John), ygreenberg@maimonidesmed.org (Y. Greenberg), fyang@maimonidesmed.org (F. Yang).

Peer review under responsibility of Indian Heart Rhythm Society.
http://dx.doi.org/10.1016/j.ipej.2016.02.010

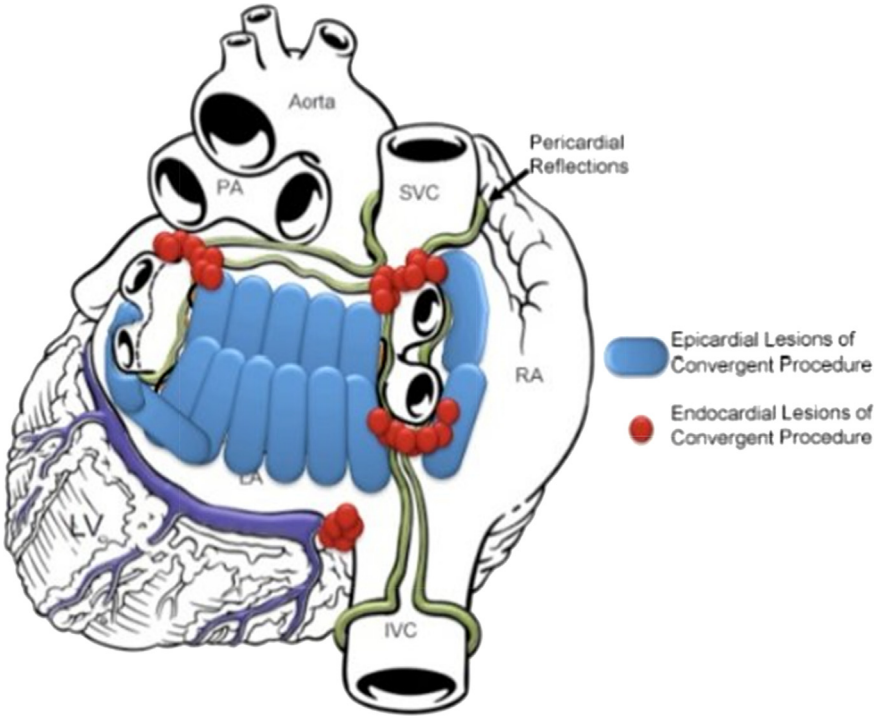

Fig. 1 – Schematic of the convergent ablation lesion pattern relative to the high stress regions. By anatomically targeting high stress regions associated with atrial remodeling, AF substrate is ablated or isolated.

for persistent and paroxysmal AF not responding to medical therapy.

Convergent AF ablation employs both trans-diaphragmatic epicardial and catheter induced endocardial ablation to electrically isolate the posterior wall of the left atrium and the area around the pulmonary veins. Ablation is associated with changes in architecture and the electrical progression across the LA. Additionally, autonomic ganglionated plexi are concomitantly ablated as they exist in the epicardial surface. These changes translate into changes in the 12-lead surface electrocardiography (ECG) and may correlate with freedom from AF.

Current literature shows P wave duration (PWD) significantly decreases after circumferential pulmonary vein isolation (CPVI), and that the decrease in PWD correlates with freedom from AF [5–11]. Some studies have assessed the change in P wave area post CPVI, however, the results are inconsistent.

Convergent ablation results in more extensive scarring and may lead to more distinct ECG changes. Data on ECG changes after this procedure is scarce. One study involving 41 patients undergoing convergent ablation reported reduction in PWD consistent with the studies involving CPVI [12]. We have assessed changes in P wave duration and P wave area (PWA) after 1 month, 3 months and 6 months of convergent ablation.

Materials and methods

Twenty-nine patients who underwent convergent ablation were included in the study. These patients had persistent AF or paroxysmal AF with enlarged atria, which did not respond to medical therapy including rate control or antiarrhythmic therapy. Six of them had undergone CPVI as well in the past.

Ablation technique

Convergent ablation procedure utilizes a transdiaphragmatic cannula and the EPi-Sense™ Guided Coagulation System with VisiTrax (nContact, Inc.). The EPi-Sense device is used to create epicardial lesions along the entire posterior wall and around the pulmonary veins (PV). The pericardial reflections limit the epicardial ablation of the superior aspect of the veins and the region below the right inferior PV. The lesion set is therefore completed endocardially by an electrophysiologist and bidirectional block is confirmed across the veins (Fig. 1). A right cavotricuspid isthmus line is also created.

ECG parameters measurement

We analyzed ECGs before (up to 6 months prior to ablation), and 1, 3 and 6 months after ablation. P wave duration, area and amplitude were measured in lead V_1, II and III as previous studies found ECG changes in these leads. Measurements were performed with use of Sketchandcalc, an online software designed for precise 2 dimensional measurements [13].

We uploaded the electronic copy of the standard 12-lead ECG onto the software, magnified it to 25 times, and made the measurements. We set the scale in the software so that one small box of the ECG strip after magnification would be equivalent to 1 mm which is the standard. We used the free drawing tool in the software, and drew under the curve of the P wave to get the area (Fig. 2). For each parameter, two