Left Posterior Wall: the real key factor in the treatment of persistent atrial fibrillation

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Abstract

The role of isolation of left posterior wall in patients with persistent atrial fibrillation on top of pulmonary vein isolation is still debatable. There are still technical issues for achieving complete left posterior wall isolation and durability of the lesions is probably the main limiting factor for promoting a successful clinical outcome

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In this issue of the Journal of Cardiovascular Electrophysiology, Sayuri et al discuss the role of isolation of left atrial posterior wall (PWI) in addition to pulmonary vein isolation (PVI) in the treatment of persistent AF patients and, in particular with regards to recurrent atrial arrhythmias (1)

More in detail, the authors compared PVI only strategy to PVI plus PWI and PWI was achieved through the creation of roof line between the two superior PVs and bottom line between the two inferior PVs (the so-called “box lesion”). They found that PWI for persistent AF was more effective in reducing episodes of recurrent persistent AF with no increase in recurrent atrial tachycardias (AT). The authors have touched a very controversial issue and whether the isolation of LPW is required or promotes additional advantages over PVI alone in patients with persistent AF is still unclear and debatable argument

Significance of Left Posterior Wall

There are reasons why PW of the left atrium needs to be included when ablation of persistent AF is planned. First, LPW shares the same embryological origin of PVs and, thus this implies that the two structures are intertwined, potentially favoring creation of different and complex circuits. In this respect, it is worth mentioning that as the left atrium (LA) develops, the PVs represent on outgrowth tissue of the LPW. This explains why the embryologic origin of LPW and PVs can provide the anatomic basis for the development of atrial arrhythmias and, in particular of AF (2,3). Second, the specific electrophysiologic characteristics of atrial myocytes within the LPW can play a role. As a matter of fact, LP atrial myocytes have a higher incidence of delayed after depolarizations and larger late sodium currents in addition to a larger intracellular Ca transients and sarcoplasmic reticulum Ca contents. A smaller protein expression of the Na-Ca exchanger has been also found. This can promote a higher propensity to arrhythmogenic behavior and lead to distinctive electrophysiological properties that may contribute to the pathophysiology of AF (4). Third, LPW in patients with persistent AF is an ideal anatomic location for significant atrial remodeling, comprising fibrosis and lymphomononuclear infiltration (5,6). Moreover, spontaneous trigger activity and so "called" rotors have been previously reported in persistent AF patients (7,8). Therefore, since secondary triggers and more complex atrial circuitries take place in LPW, it appears reasonable that their elimination may be a crucial adjuvant strategy for providing a better clinical outcome.

Does the current knowledge suggest a more aggressive approach?

As the ablative techniques and the technology in the field evolve, how to perform isolation of LPW remains a very debatable, controversial issue. Studies in which creation of linear lesions as to isolate LPW have been employed, have produced different results (1,9). In this respect, Tamborero et al reported that LPWI provided by linear lesions does not improve the clinical outcome of circumferential PVI. They have provided LPWI by performing a roof line and a floor line (two lines connecting the contralateral PV encircling lesions). In addition, mitral isthmus ablation was performed in all patients. In the study by Sayuri et al, the same pattern of lesions has been proposed, but several issues need to be addressed when linear lesions in the LA posterior wall are taken in account. There is an inherent technical difficulty to provide a successful electrical LPW isolation by a set of linear radiofrequency lesions, due to the complex anatomical architecture of the atrial musculature. Again, even if conduction block along the lines is achieved during the procedure, one cannot rule out the occurrence of gaps over time and, thus dormant conduction may take place during the follow-up. In fact, in the study by Sayuri et al, reconnection of posterior wall is reported in 65% of patients after the second procedure. Nearly 70% of patients in the study by Tamborero et al had reconnection of the roof line or recurrence of electrical activity within the LPW that led to AF relapses. Therefore, it is conceivable that there are still doubts about the durability of linear lesions in the LPW for the promotion of "durable box lesion". Needless to say that all these attempts of LPWI without proven of effective isolation of the target structure make difficult to properly assess the true impact of this ablative approach on clinical outcome at follow-up. This does not mean that isolation of LPW is not worth performing. Indeed, surgical isolation of the LPW has been proved to be durable and effective in improving the freedom from atrial arrhythmias in patients with any kind of clinical presentations of AF (10). In this regards, the effectiveness of LPWI has been recently highlighted by hybrid approach, in which surgeon and electrophysiologist are side-by-side as to achieve the best clinical results in patients with persistent AF (11). In particular, the hybrid Convergent procedure as a minimally invasive closed-chest procedure performed on the beating heart that combines epicardial RF ablation—focused on the LPW—followed by complementary endocardial catheter ablation has been proved to significantly reduce the AF burden and improve the clinical outcome of patients with persistent and long-persistent AF. In detail, the epicardial component seeks to debulk as much of the LPW as can be accessed, principally limited by the oblique sinus. Posterior segments of the PV ostia/antra may also be reached and ablated in most cases. The endocardial component supplements the epicardial lesions around the pericardial reflections and any incompletely ablated LPW areas and addresses any remaining gaps between the PV and LPW lesion sets (including anterior segments), ensuring PV electrical isolation. The importance to deliver epicardial and endocardial lesions set is mainly dictated to overcome the degree of disparity between the endocardium and epicardium that can induce and sustain fibrillatory activity. Therefore, the overlap between the epicardial

and endocardial lesion sets is preferred to avoid arrhythmogenic gaps and ensure transmurality. Single- and multicenter studies have reported freedom from AF or any atrial tachyarrhythmia to be 66%–95% at 1 year after the hybrid Convergent procedure, with 52%–81% arrhythmia-free without antiarrhythmic drugs (see 7 Malaki) A report of 81% of patients in SR after 4 years suggests favorable durability but additional long-term data are necessary(see 23 Malaki). These results are especially encouraging since the procedure has been frequently used in the most refractory patient populations.

The need to improve effectiveness

The overall information that we collect from these experiences notifies us that LPW plays a pivotal role in the maintenance of AF and it should be included in the ablative approach of patients with persistent AF. Probably in order to obtain an effective and durable LPWI the scheme of lesions should be properly revisited as to reduce the likelihood of electrical reconnection of the posterior wall. My own perplexity is about the ablative modality of creating linear lesions reported in this and other studies, since the rate of inconsistency of the lesions connecting the contralateral PVs is well documented. In this regards, the promotion of LPW homogenization by moving a circular catheter around the PV antrum can significantly reduce the arrhythmia recurrence rate as compared to the circle of contiguous lesions (12). Unfortunately, even in the study by Sayuri et al the rate of LPW reconnection is high, underlying the technical difficulty to achieve a durable effectiveness. The good news from the study is revealed by the lower occurrence of atrial tachycardia (AT, 9%) in patients who underwent PVI plus LPWI and this is much lower than in previous studies, where the rate of recurrent AT varied from 5% to 59%. (see 21-23 Sayuri). On the other hand, due to the disparity of approaches employed in the different studies, it is difficult a fair and objective comparison. Due to the observational nature of this single center study and the limited number of patients included, caution needs to be advocated concerning the value of creation linear lesions with the current technology. The emerging ablative techniques, such as high power-short duration (see 27 Sayuri) and the use of ablation index (see 28 Sayuri) or the promising thermal/non-thermal pulse field ablation technology might constitute the technical key improvement to provide an effective LPWI. Future studies are needed to evaluate whether these additional approaches improve clinical outcomes, provided isolation of LPW is guaranteed

Even with the inherent limitations of the study, we need to applaud Sayuri er al for drawing our attention to the pivotal role of left posterior wall in the initiation and maintenance of AF and, thus reinforcing the concept of walking out of the PVs towards the posterior wall. Achieving proven isolation of LPW is essential to promote additional benefits over PVI alone in the treatment of persistent AF and the adoption of new ablation settings and novel energy delivering is required to improve procedural outcome over the follow-up

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