

## Original Article

# *Left and Right Approach Atrioventricular Junctional Ablation in Patients With Permanent Atrial Fibrillation*

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### ABSTRACT

**Background:** Despite the clear beneficial effects of atrioventricular nodal ablation (AVNA) in atrial fibrillation (AF), the differences in these effects between the 2 technical methods of AVNA—retrograde and antegrade approaches—remain unclear. The present study aimed to compare the outcome of these 2 AVNA approaches in AF.

**Methods:** This clinical trial was performed on 109 consecutive patients candidated for cardiac resynchronization therapy (CRT) due to the presence of simultaneous heart failure and AF. The eligible patients were randomly scheduled for CRT via left AVNA or CRT via right AVNA or medical treatment approaches.

**Results:** No statistically significant differences were observed between the right (3.12–1.88) and left (3.12–1.78) approaches of AVNA regarding a decrease in New York Heart Association score as well as an increase in left ventricular ejection fraction (18.0%–23.75% in the right approach and 18.46%–25.77% in the left approach). Although the severity of mitral regurgitation significantly decreased following both CRT via the left AVNA approach and CRT via the right AVNA approach, the reduction in the severity of mitral regurgitation was more prominent in those treated by CRT via the right AVNA approach.

**Conclusions:** In reducing the severity of mitral regurgitation as well as femoral complications, right AVNA was superior to left AVNA, while left AVNA was preferable to right AVNA concerning the escape rate, procedure time, and radiofrequency rate. (*Iranian Heart Journal 2016; 17(2):12-17*)

**Keywords:** Atrial fibrillation ■ Atrioventricular junctional ablation ■ Cardiac resynchronization therapy

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Despite the established efficacy of cardiac resynchronization therapy (CRT) in congestive heart failure due to systolic dysfunction, the beneficial effects of this technique in atrial fibrillation (AF) still remain uncertain. According to the latest European guidelines, CRT is beneficial in patients with permanent AF with the same indications of sinus rhythm (class IIa, level of evidence: B) and atrioventricular junctional ablation should be considered in cases of incomplete biventricular pacing (class IIa, level of evidence: B).<sup>1</sup>

The limited available evidence suggests the favorable effects of CRT in the AF setting. Initial reports showed the beneficial effects of CRT on hemodynamic parameters at short-term follow-up.<sup>2,3</sup> Furthermore, recent studies investigating the long-term effects of CRT in AF have demonstrated improvements in New York Heart Association (NYHA) functional class, exercise capacity, left ventricular ejection fraction (LVEF), and quality of life.<sup>4-8</sup> However, there is also some evidence to suggest that CRT may not be as effective as was previously reported for patients with AF undergoing CRT.<sup>9-13</sup> Several factors have been cited for this observation. Firstly, AF precludes the atrioventricular optimization of CRT. Secondly, a high intrinsic ventricular response leads to electrical fusion and reduces biventricular pacing capture and, consequently, cardiac output.<sup>14,15</sup> Importantly, randomized controlled clinical outcome trials of CRT have almost always excluded patients with AF. In this regard, current guidelines from the American College of Cardiology/American Heart Association/Heart Rhythm Society and the European Society of Cardiology (class IIa, level of evidence: B) endorse the use of CRT in patients suffering from AF with LVEF  $\leq$  35% and ventricular dyssynchrony.<sup>16-18</sup> However, both guidelines advise that atrioventricular nodal ablation (AVNA) may be required to ensure complete biventricular capture in patients with AF. This approach can reduce mortality as well as

improve functional capacity and LV functional status in patients with AF.<sup>19,20</sup>

Despite the clear beneficial effects of AVNA in patients with AF, the differences in these effects between the 2 technical methods of AVNA—retrograde and antegrade approaches—remain unclear. The present study aimed to compare the outcome of these 2 AVNA approaches in AF.

## METHODS

This clinical trial was performed on 109 consecutive patients candidated for CRT. The inclusion criterion was the presence of simultaneous heart failure and AF rhythm. The exclusion criteria were comprised of a history of receiving ablation therapy and implantable cardioverter defibrillators or pacemaker insertion.

On admission, the baseline data—including demographics, medications, medical history, duration of AF, and echocardiographic parameters—were assessed and recorded. The eligible patients were then randomly scheduled for CRT via left AVNA (n = 32), CRT via right AVNA (n = 26), and medical treatment (n = 51). The study end point was to compare the postprocedural outcome—including AVNA success rate, AF relapse, and postoperative complications—between the 2 AVNA techniques.

For the statistical analyses, the results are presented as means  $\pm$  SDs for the quantitative variables and were summarized by absolute frequencies and percentages for the categorical variables. Normality of data was analyzed using the Kolmogorov–Smirnov test. The categorical variables were compared using the  $\chi^2$  test. The quantitative variables were also compared using ANOVA or the Kruskal–Wallis *H* test. For the statistical analyses, SPSS, version 16.0 for Windows (SPSS Inc., Chicago, IL), was used. A  $P \leq 0.05$  was considered statistically significant.

## RESULTS

The 3 groups were similar in terms of gender, etiology of the disease (ischemic or idiopathic), mean age, and QRS duration on ECG (Table 1). There was also no difference across the 3 groups in the baseline NYHA score. However, after AVNA, the mean NYHA score decreased significantly in CRT via left AVNA (3.12–1.78) compared to medical treatment (2.96–2.16), but no difference was revealed in the mean NYHA score between the 2 modalities of CRT via the left and right approaches (Table 2). Also, the mean LVEF was similar between the 3 groups at baseline, but the post-treatment LVEF was significantly high following CRT via the right AVNA approach when compared to medical treatment. In this regard, no difference was found in the mean postoperative LVEF between the 2 procedures of CRT via the left and right approaches.

As is shown in Table 2, no differences were found between the 3 groups in terms of LV end-systolic and end-diastolic diameters before and also after the treatments. Regarding the severity of mitral regurgitation (MR), no difference was revealed in pretreatment MR severity across the 3 groups. Although the severity of MR significantly decreased following both CRT via the left and right AVNA approaches, MR severity reduction was more prominent in those treated with CRT via the right AVNA approach (Table 2).

There was no difference in total hospital stay between the 2 groups treated with CRT via the left and right AVNA approaches, but it was significantly short in both groups when compared to those treated medically. Similarly, the mean biventricular pacing was lower in both groups treated with CRT via left AVNA and CRT via right AVNA than in the medical treatment group, without difference between the 2 former groups.

**Table 1.** Baseline characteristics of the study population

Item		CRT, Left AVNA	CRT, Right AVNA	Medical Treatment	P
Gender	Male	24 (75.0%)	18 (69.2%)	33 (64.7%)	0.615
	Female	8 (25.0%)	8 (30.8%)	18 (35.3%)	
Etiology	Ischemic	20 (62.5%)	16 (61.5%)	29 (59.6%)	0.856
	Idiopathic	12 (37.5%)	10 (38.5%)	22 (43.1%)	
Age, y		56.12 (±14.70)	58.23 ± 14.39	54.67 (±15.21)	0.609
QRS duration, msec		161.69 (±23.65)	156.69 (±21.04)	153.98 (±20.86)	0.295

AVNA, Atrioventricular nodal ablation

**Table 2.** Clinical and echocardiographic parameters before and after treatment

Item		CRT, Left AVNA	CRT, Right AVNA	Medical Treatment	P
NYHA Class	Before	3.12 (±0.49)	3.12 (±0.43)	2.96 (±0.53)	0.248
	After	1.78 (±0.79)	1.88 (±0.52)	2.16 (±0.64)	0.036
LVEF	Before	18.05 (±5.12)	18.46 (±5.29)	18.43 (±5.61)	0.946
	After	23.75 (±7.30)	25.77 (±4.40)	22.30 (±4.76)	0.030
LVEDD	Before	6.60 (±0.58)	6.95 (±0.57)	6.72 (±0.71)	0.130
	After	8.13 (±10.21)	6.44 (±0.61)	7.54 (±8.09)	0.712
LVESD	Before	5.85 (±0.63)	5.91 ± 0.74	5.86 (±0.76)	0.948
	After	5.48 (±0.58)	5.53 ± 0.67	5.54 (±0.69)	0.921
Severe MR	Before	13 (40.6%)	6 (23.1%)	16 (31.4%)	0.198
	After	1 (3.1%)	1 (3.8%)	5 (9.8%)	0.044

NYHA, New York Heart Association; LVEF, Left ventricular ejection fraction; LVEDD, Left ventricular end-diastolic diameter; LVESD, Left ventricular end-systolic diameter; MR, Mitral regurgitation

The mean ( $\pm$ SD) procedure time was 20.81 ( $\pm$  4.86) minutes in the left AVNA group and 26.15 ( $\pm$  8.31) minutes in the right AVNA group, which was significantly lower in the former group ( $P=0.003$ ). There was no difference in the rate of femoral artery complications between the left AVNA group and the right AVNA group (9.4% vs. 3.8%;  $P=0.620$ ). The mean radiofrequency rate was significantly lower in the left AVNA group than in the other group (1.44 [ $\pm$  0.72] vs. 1.92 [ $\pm$  0.69];  $P = 0.011$ ). The mean escape rate was also lower in the left AVNA group than in the right AVNA group (23.22 [ $\pm$  9.66] vs. 34.08 [ $\pm$  8.76];  $P = 0.001$ ).

## DISCUSSION

Reviewing the literature documents this fact that almost all studies on the effects of CRT on AF management have mainly focused on comparing this approach with and without concurrent AVNA and thus no study has been published to compare the retrograde and antegrade AVNA procedures. Therefore, we tried to compare the procedural outcomes—including functional status, echocardiographic parameters, and post-ablation complications. Our results showed no differences between left and right AVNA regarding improvement in function class, LV systolic function, and LV diameters. However, compared to medical treatment, the effectiveness of the 2 AVNA-based procedures was demonstrated. Be that as it may, as regards MR severity and femoral complications, right AVNA was superior to left AVNA, while left AVNA was preferable to right AVNA in terms of escape rate, procedure time, and radiofrequency rate. Thus, we think that the superiority of one technique to another cannot be concluded concretely based on the findings; this necessitates further assessments with long-term follow-ups.

As has been previously shown, most previous studies have highlighted the effects of AVNA on cardiac performance indices. In a previous

study, the ablation of the AV node was associated with a reduction in all-cause mortality.<sup>21</sup> In a systematic review, the response rate to CRT in patients who underwent AVNA was significantly higher than that in those not scheduled for AVNA.<sup>22</sup> In another study, although mortality rate was similar between the group undergoing CRT via AVNA and the group with sinus rhythm, cardiac-related mortality was considerably lower in the former group (8.1% vs. 11.1%).<sup>23</sup> In another study, AF response to CRT via AVNA was significantly higher than that in those with sinus rhythm.<sup>24</sup> In a study by Himmel et al.,<sup>25</sup> function class, LVEF, and left ventricular end-diastolic diameter all improved following CRT via AVNA. Finally, in a survey by Brignole et al.,<sup>26</sup> heart failure deterioration and its concomitant hospitalization in the groups treated with and without CRT were 11% and 26%, respectively, with a significant difference. In conclusion, despite the significant therapeutic effects of CRT via AVNA on functional capacity and echocardiographic indices, the effects of the left and right AVNA procedures are similar in the short term. However, right AVNA was superior in the improvement of MR severity as well as postoperative femoral complications, while procedure time, radiofrequency rate, and escape rate were all lower in the left AVNA procedure.

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