

less frequent in older patients, despite demonstrated mortality reductions with this approach in all age groups.<sup>2</sup>

In conclusion, in daily clinical practice it is common to encounter patients with AMI who are treated conservatively, without coronary angiography (approximately 1 in 10). These patients have a poor cardiovascular risk profile and a dismal prognosis (Figure), with mortality exceeding 20% during hospital care and approaching 50% during postdischarge follow-up. Killip class is the only predictor of mortality during hospitalization, and age is the variable most strongly associated with mortality during follow-up.

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## Low Recurrence Rate After Nodal Reentrant Tachycardia Cryoablation With an 8-mm Tip Catheter and Prolonged Applications



### Reducción de las recurrencias tras crioablación de taquicardia reentrante nodal con catéter de 8 mm mediante crioaplicaciones prolongadas

#### To the Editor,

Comparative studies of radiofrequency catheter ablation and cryoablation for nodal reentrant tachycardia report similar short-term outcomes, with success rates above 95%.<sup>1,2</sup> Of note is the fact that radiofrequency ablation is associated with a risk of atrioventricular block of 0.75%,<sup>1</sup> whereas no cases of permanent atrioventricular block have been reported with cryoablation. In contrast, a higher recurrence rate has been reported after cryoablation with 4- and 6-mm catheters, although this problem can be overcome by increasing the lesion size with 8-mm catheters.

Our objective was to assess the efficacy and safety of cryoablation of nodal reentrant tachycardia with an 8-mm catheter immediately after the procedure and after a 1-year follow-up and to analyze the possible factors associated with long-term success.

We retrospectively reviewed our experience of consecutive patients with this type of arrhythmia who were treated with an 8-mm cryoablation catheter (Freezor<sup>®</sup> MAX, Medtronic; Minneapolis, Minnesota, United States) between May 2008 and January 2013 and who were in clinical follow-up for at least 1 year.

The cryoapplications were performed at  $-80^{\circ}\text{C}$ , preferably at the lower third of the Koch triangle, with the aim of abolishing or modifying conduction in the slow pathway and suppressing the inducibility of tachycardia. During these ablations, the patients underwent electrophysiological assessment, and application was interrupted in the event of lack of efficacy.

At the beginning of the study period, the duration of cryoapplications after initial success was 4 minutes (23 patients), whereas in the last 18 months, the duration was 8 minutes (39 patients). Neither freeze-thaw-freeze cycles nor safety applications were used.

After the procedure, all antiarrhythmic drugs were discontinued and the patients entered clinical and electrocardiographic follow-up for 12 months or until clinical recurrence. Recurrence was defined as persistence of symptoms with electrocardiographic documentation of the arrhythmia.

The demographic characteristics of the patients and the main findings are summarized in Table. An initial successful outcome was achieved in 61 of the 62 patients (98%). In 8 patients (12.9%), transient atrioventricular block was documented during the cryoapplications (PR prolongation). In all patients, this event completely resolved within seconds of interrupting the application. There were no other complications.

After a mean follow-up of 10.7 months (95% CI, 9.8–11.5 months), 8 patients (12.9%) with successful initial outcomes experienced recurrence, in all cases within 6 months of cryoablation (Figure).

Significant differences were found in the recurrence rate in patients who received 4-minute cryoapplications (7 of 23, 30%) vs those who received 8-minute cryoapplications (1 of 39, 3%;  $P = .003$ ).

There were no significant differences in the recurrence rate according to the initial outcome of cryoablation when the the

**Table**

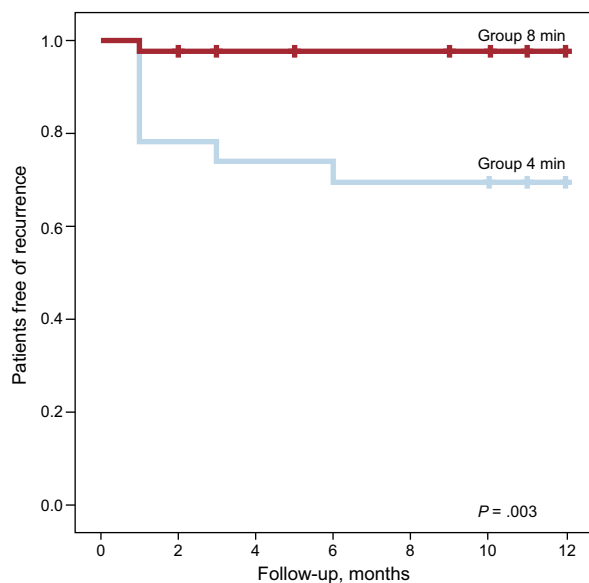
Clinical Characteristics of the Patients and Outcomes

Age, mean (SD), y	43.5 (16.1)
Sex, female/male	16/46 (74% women)
Structural heart disease, yes/no	3/59 (92% without heart disease)
First procedure, yes/no	57/5 (92% first procedure)
Common NRT, yes/no	55/7 (89% common NRT)
Initial success, yes/no (%)	61/1 (98.4%)
Number of cryoapplications/patient, mean (SD)	4.9 (3)
Recurrences, yes/no (recurrence rate, %)	8/62 (12.9%)
Recurrences, yes/no (recurrence rate, %) according to application time:	
4 min	7/23, 30% <sup>a</sup>
8 min	1/39, 3% <sup>a</sup>
Recurrences, yes/no (recurrence rate, %) by complete abolition or not of slow pathway	
Complete abolition	2/21 (9.5%) <sup>b</sup>
Residual single echo	6/41 (14.6%) <sup>b</sup>
Transient prolongation of PR interval, yes/no (%)	8/62 (12.9%)
Complete atrioventricular block, yes/no	0/62

NRT, nodal reentrant tachycardia; SD, standard deviation.

<sup>a</sup>  $P = .003$ .

<sup>b</sup>  $P = .4$ .



**Figure.** Outcomes presented as a Kaplan-Meier plot of recurrence after cryoablation. Red line: 8-minute application group; blue line: 4-minute application group.

21 patients with complete abolition of conduction through the slow pathway (recurrence rate of 9.5%) were compared with the 41 patients with residual conduction through the slow pathway with a single echo beat (recurrence rate of 14.6%,  $P = .4$ ). The other variables analyzed were not associated with a higher recurrence rate.

The main findings in this series of patients with nodal reentrant tachycardia treated with cryoablation with an 8-mm catheter are as follows: *a*) we confirmed that the initial efficacy in an adult population is very high, with similar success rates to those obtained with radiofrequency ablation; *b*) the safety profile was excellent, even with 8-mm catheters, which do not allow cryomapping; *c*) our results suggest that the recurrence rate during the first year can be reduced by extending the duration of initially successful application to 8 minutes; *d*) modification of the slow pathway was not found to be important, as failure to detect anterograde conduction was not associated with better clinical outcome than residual conduction inducing a single echo beat.

The most controversial aspect of cryoablation is the higher recurrence rate associated with this technique compared with radiofrequency (10% vs 4%, respectively).<sup>1</sup> There is a lack of

comparative studies, but the recurrence rates in the published series with 8-mm catheters of around 5% are lower than those reported with cryoablation with 4- and 6-mm catheters and are similar to those reported with radiofrequency ablation. These results may have been influenced by the conditions in which cryoablation was applied. For example, Chan et al,<sup>3</sup> who reported a relapse rate of 5.6%, performed a security freeze in the same area as the successful application, and Peyrol et al,<sup>4</sup> who reported a recurrence rate of 4.9%, also mention that they performed an additional application of 4 minutes at the site of successful application. Bearing in mind that tissue adherence is lost during periods of heating and thus precision may be lost, we decided to simply extend the duration of cryoapplications from 4 minutes to 8 minutes in our patients.

If low recurrence rates were to be confirmed in larger prospective series when applications are extended to 8 minutes, this catheter and application method could improve the outcomes of treatment of nodal reentrant tachycardia with cryoablation.

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## Phospholamban p.Arg14del Mutation in a Spanish Family With Arrhythmogenic Cardiomyopathy: Evidence for a European Founder Mutation



### Mutación p.Arg14del en fosfolambán en una familia española con miocardiopatía arritmogénica: evidencia de una mutación europea fundadora

To the Editor,

Phospholamban is an inhibitor of the sarcoplasmic calcium pump, which regulates contractility and relaxation. Mutations in its gene, *PLN*, have been associated with aggressive phenotypes of

both dilated cardiomyopathy and arrhythmogenic right ventricular cardiomyopathy.<sup>1,2</sup>

Herein we report a family diagnosed with arrhythmogenic cardiomyopathy with some peculiar features, carrying a Dutch founder mutation in phospholamban (*PLN* c.40\_42delAGA; p.Arg14del).<sup>3</sup> The genotype-phenotype correlation allowed the identification of some red flags, which should lead to suspicion of this mutation in the clinical work-up.

The proband (III.2, Figure 1) was a 28-year-old woman with a past medical history of presyncope. The electrocardiogram (ECG) showed QS inferiorly and striking low voltages throughout all leads (Figure 2).

Echocardiography showed a nondilated left ventricle with global hypokinesia and a left ventricular ejection fraction of 40%.