

## SCIENTIFIC LETTER

# Comparison of radiofrequency versus cryotherapy catheter ablation of septal accessory pathways

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Approximately 30% of all accessory pathways are located in the “septal” area. As these pathways are close to the atrioventricular node, there is an increased risk of right bundle branch block or inadvertent complete atrioventricular block during catheter ablation.<sup>1</sup> Lesions created by radiofrequency (RF) energy inevitably involve some degree of tissue disruption and are irreversible.

As cryotherapy energy has the ability to reversibly show loss of function of tissue with cooling (“ice mapping”) at less negative temperatures, and progressive ice formation at the catheter tip causes adherence to the adjacent tissue, this ablation method potentially has advantages over RF for safe ablation of septal accessory pathways.<sup>2–4</sup> In this retrospective study we compare transvenous RF with cryoablation in patients with septal accessory pathways.

## METHODS

Between January 2000 and October 2001, 15 patients were treated with RF and the next consecutive nine patients with cryoablation for septally located accessory pathways. The final classification of the accessory pathways was made according to the successful ablation site on fluoroscopy.

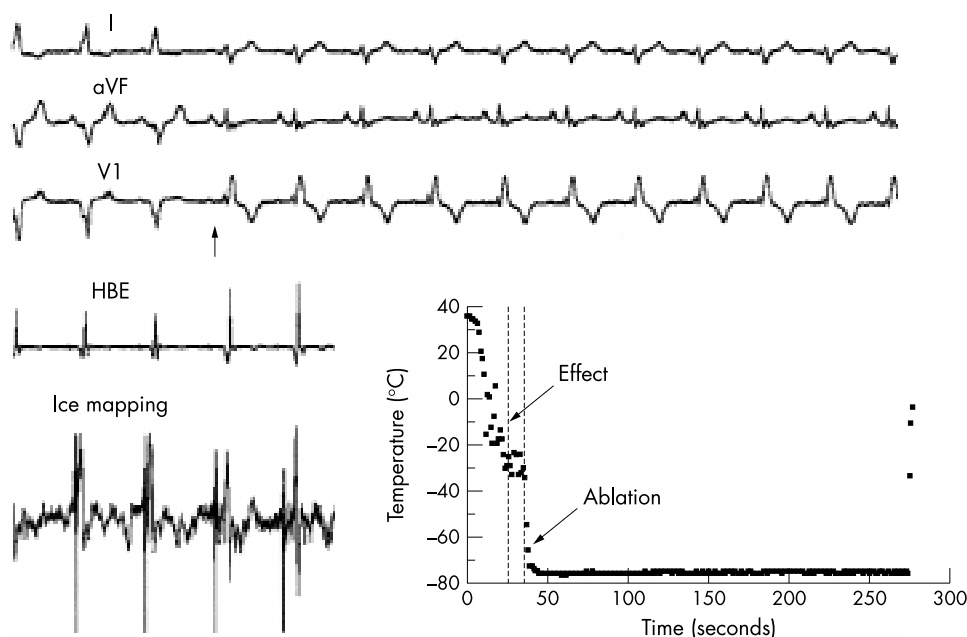
A standard electrophysiological study was performed and, after confirmation of the presence of an accessory pathway, transvenous RF or cryoablation was carried out.

Mapping was performed beginning at the anteroseptal region at the His deflection down to the coronary os and further to the right posterior region. For both energy forms standard techniques were used to identify prospective ablation sites. For cryoenergy procedures, initially ice mapping was done by cooling to  $-30^{\circ}\text{C}$  for a maximum of 80 seconds with

the use of a 7 French cryocatheter (Freezor, curve 3, CryoCath Technologies Inc, Montreal, Quebec, Canada). Because of the catheter adherence, incremental atrial pacing and ventricular extrastimulus testing were used to show preserved normal atrioventricular conduction and decremental concentric ventricular conduction, respectively. If there was a sudden loss of ventricular pre-excitation or sudden termination of the tachycardia, cryoablation was performed by cooling to  $-70^{\circ}\text{C}$  for four minutes to create a permanent lesion (fig 1). The pacing protocol, as well as single atrial and ventricular extrastimuli, were repeated to conclude a successful ablative procedure immediately and after a 30 minute waiting period. Eight weeks after discharge, the patients were seen at the outpatient clinic. Continuous variables are expressed as mean (SD). Non-parametric data were compared by a Mann-Whitney test. The level of significance was set at  $p < 0.05$ .

## RESULTS

Locations of accessory pathways in the RF and cryogroup were left posteroseptal in six versus one, right posteroseptal in seven versus two, midseptal in one versus two, and anteroseptal in one versus two patients, respectively. The procedure was successful in 12 patients (80%) in the RF group and in six (67%) in the cryogroup. Success was temporary during and after several applications in one patient in the RF group and in the remaining three patients in the cryogroup. The unsuccessfully ablated pathways were located left (one) and right (two) posteroseptally in the RF group, and left posteroseptally (one), right posteroseptally (one), and midseptally (one) in the cryogroup.



**Figure 1** Right posteroseptal accessory pathway. The insert shows the curve of temperature versus time. Shown are leads I, aVF, and V1, His bundle electrogram (HBE), and signal from the ablation catheter. Appearance of right bundle branch block (arrow), without an intermediate stage of normal ventricular activation, 26 seconds after ice mapping is started and a few seconds after  $-30^{\circ}\text{C}$  was reached. Ablation is commenced at 36 seconds (which allowed 10 seconds of additional observation of the rhythm), with immediate lowering to  $-73^{\circ}\text{C}$  for four minutes.

In the RF group a median of 9 (range 1–34) applications were applied versus 2 (range 1–21) in the cryogroup. Procedure and fluoroscopy times were comparable. In both groups one patient developed right bundle branch block. These blocks remained present after one day. It was incomplete in the cryothermy patient and disappeared at the first ambulatory follow up after six weeks. One patient in the cryogroup had a temporary inadvertent complete heart block 30 seconds after ice mapping. It resolved spontaneously and was probably mechanically induced. One patient in the RF group had a cardiac tamponade and needed pericardiac drainage. After successful procedures, no late recurrences were observed in the RF group. Six weeks after ablation, one patient in the cryogroup experienced recurrent palpitations, although no tachycardia was documented. She is asymptomatic on sotalol. In two of three patients with a failed first ablation attempt in the RF group, a repeat procedure was successful. Repeated procedure with cryoenergy failed in two patients and was successful in one. However, one of the two patients with failed cryoenergy had intermittent pre-excitation. There was no crossover of procedures from cryoablation to RF to have a more reliable comparison between both techniques. If we include the repeat procedures, RF was successful in all versus seven of nine complete successes (78%) in the cryogroup, with one additional intermittent pre-excitation.

## DISCUSSION

RF ablation of septally located accessory pathways is associated with a higher percentage of failures and recurrences than with other locations, and inadvertent complete heart block or new right bundle branch block may occur.<sup>1</sup> The rationale for attempting cryoablation in these sites is double: enhancing safety with ice mapping of prospective ablation sites and improving efficacy.<sup>2–4</sup>

This retrospective study compared RF with cryoablation for septally located accessory pathways. The primary, acute success rates for both treatment modalities were comparable. The median number of applications tended to be lower with cryoablation than with RF energy, and this may decrease tissue damage which can be both harmful and proarrhythmic in the long term. The procedure and fluoroscopy times were equal for both study groups, although in the cryogroup fluoroscopy time tended to be shorter, certainly when considering only successful procedures. This is an important asset and may be because continuous fluoroscopy is not necessary during cryoenergy application.

After a repeat procedure with the same energy, 100% success was achieved with RF. This was not reached with cryothermy, although the difference was not significant. The first explanation may be that cryoablation was carried out only if ice mapping was successful—that is, it was effective and normal atrioventricular conduction was preserved. This cautious approach leads to fewer applications.<sup>4</sup> It is possible that during ice mapping, intramural or more epicardially located accessory pathways were not reached at all, as the

cooling was not deep enough to have any effect (while, theoretically, it could have been the right spot). However, cooling to temperatures less than  $-30^{\circ}\text{C}$  can create irreversible lesions, and therefore also inadvertent complete atrioventricular block.<sup>2–4</sup>

Secondly, lesions created by cryothermy are probably different in size and certainly in composition from lesions created by RF catheters. This may mean that a more precise mapping, a larger catheter tip, or further cooling is necessary to achieve the same effect. Thirdly, an important explanation for a failing attempt is inadequate mapping. As the same operators performed both RF and cryoablation an operator effect can be excluded.

Lastly, as this is a new technique, a learning curve exists.<sup>5</sup> The cryocatheter is not yet as steerable as a conventional RF catheter and this could have limited proper positioning of the cryoablation catheter, especially for left sided posteroseptal sites.

This analysis certainly is facing several limitations, including its retrospective character and the small number of patients. We can easily foresee a similar, prospective trial, but we realise that this study cannot be repeated, as the environment in ablation is changing very fast. New mapping technologies have a serious impact on procedure duration and fluoroscopy time. Future trials have to be done with such technology. Furthermore, the three (or four) different subgroups pose different specific problems, which cannot be addressed in a small trial.

In conclusion, transvenous cryothermy catheter ablation seems to be an effective new technique with unique features such as ice mapping and cryo-adherence, making it especially useful in ablation of “delicate” accessory pathways or slow pathways in atrioventricular nodal re-entrant tachycardia.

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