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Cryoablation in an Infant Receiving Extracorporeal Membrane Oxygenation Support

Crioablación en lactante en soporte con oxigenador extracorpóreo de membrana

To the Editor,

We present the case of a 4-month-old male infant (6.4 kg) referred to our center from another hospital with incessant tachycardia with poor clinical tolerance. On admission, ECG showed a regular tachycardia at 190 bpm, with narrow QRS, clearly visible P waves, which were negative in the inferior leads, an AV ratio of 1:1, and an RP interval longer than the PR interval, all of which suggested a permanent junctional reciprocating tachycardia or Coumel tachycardia (Figure 1). Echocardiography showed severe left ventricular failure with a shortening fraction of 14%. He was therefore admitted to the neonatal intensive care unit.

The tachycardia could not be controlled despite electrical cardioversion and antiarrhythmic drugs (esmolol, amiodarone), with immediate recurrence. Over the following hours, he deteriorated clinically and developed cardiogenic shock; adequate cardiac output could not be achieved despite inotropic drugs. Therefore, extracorporeal membrane oxygenation (ECMO) was started for hemodynamic support via the right carotid artery and jugular vein.

The following day the patient underwent an electrophysiological study with ECMO support. The electrode catheters were introduced via the right femoral vein. Standard stimulation maneuvers were performed, confirming the diagnosis and the presence of a midseptal concealed accessory pathway with slow conduction.

Initially, ablation was aimed at the point of earliest retrograde atrial activation, using a radiofrequency catheter with a 4-mm point/tip (Marinr 5 Fr, Medtronic Inc; Minneapolis, USA). Although this had transient success, the temperature (55°C) repeatedly limited application, reaching very low power (4 W), and the arrhythmia recurred within a few seconds. Even with small movements of the catheter, higher power could not be achieved. On the assumption that there was low flow in the right atrium, due to the ECMO removing blood from the right atrium, a 6-mm cryoablation catheter was introduced (7 Fr, Freezor Xtra, Medtronic Inc; Minneapolis, USA). During the cryomapping (-35°C), the tachycardia was interrupted by a retrograde block in the accessory pathway, which did not affect atrioventricular conduction (Figure 2A, Figure 2B, Figure 2C, Figure 2D). Therefore, cryoablation (–80°C) was applied for 240 seconds. The patient progressed well after the procedure, ECMO and the vasoactive drugs were weaned, and he was finally discharged at 3 weeks. The ejection fraction was completely normalized at 3 months and, to date, there have been no recurrences.

Permanent junctional reciprocating tachycardia is an uncommon form of supraventricular tachycardia, mediated by an accessory pathway with slow conduction, which is usually located in the posteroseptal region. It typically presents in the first few decades of life, particularly in infants and, due to the slow conduction properties of the accessory pathway, it is often incessant, which can lead to tachycardiomyopathy in up to 18% of patients. However, inotropic drugs and hemodynamic support are rarely needed.[1] In this case, the patient's unfavorable clinical progression to refractory cardiogenic shock necessitated ECMO.

Although antiarrhythmic drugs are the first-line treatment for these arrhythmias, most patients need ablation to avoid recurrence in the long-term. In experienced centers, ablation can have high success rates and a low risk of complications even in infants.[1,2]

Radiofrequency is the most commonly used energy source for catheter ablation. To ensure that the lesion created is permanent, sufficient power must be effectively delivered to the tissue.

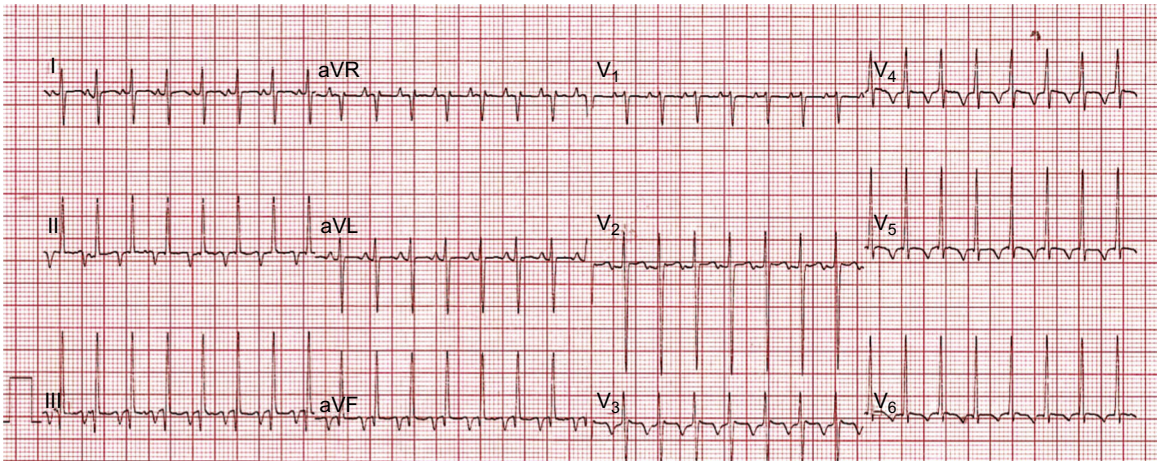

Figure 1. Electrocardiogram on admission, typical of paroxysmal junctional reciprocating tachycardia.

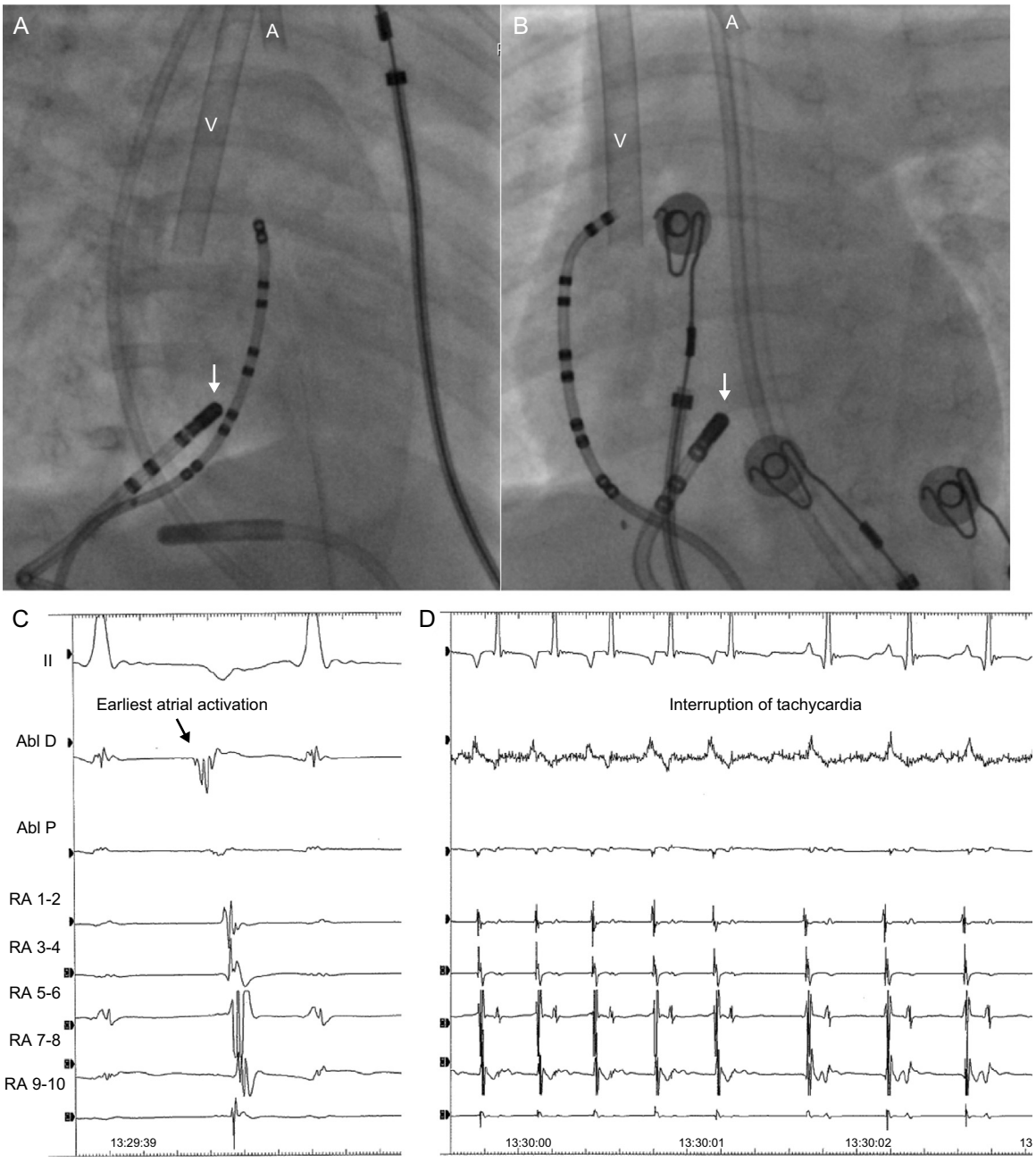

Figure 2. Right anterior oblique (A) and posteroanterior (B) radiological projections showing the position of the cryoablation catheter in the midseptal region (arrow), where the earliest atrial activation was recorded (C). During cryomapping of this point, the tachycardia was terminated (D). Note the venous (V) and arterial (A) cannulae on the fluoroscopy images.

However, when applied to areas of low flow (such as inside the coronary sinus), there is insufficient cooling of the catheter tip. The tip heats up rapidly and reaches the temperature limit, and adequate power cannot be reached. In this case, the removal of blood by the ECMO venous cannula caused low flow in the right atrium, which limited the power delivery with conventional radiofrequency. Irrigated-tip catheters are the most frequently used solution for this problem.[3] However, there are few experimental or clinical data on the effects of applying irrigated-tip catheters to the developing myocardium, such as that of children.[4]

In this case, cryoablation was used as an alternative energy source to get around this limitation. Cryoablation also has an excellent safety profile, which has made it the treatment of choice for perinodular tissue in many centers performing ablation in pediatric patients. However, we must remember that the currently available catheters are stiff and relatively large, so their use in small children is limited.[5]

This case demonstrates a new advantage of cryoablation: the creation of an effective lesion is independent of the surrounding flow, which is important in patients requiring external hemodynamic support (ECMO).

CONFLICTS OF INTEREST

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Relationship Between Carotid Intima-media Thickness and the Results of Exercise Echocardiography in Patients With Suspected Coronary Disease

Relación entre el grosor intimomedial carotídeo y el resultado del ecocardiograma de ejercicio en pacientes con sospecha de enfermedad coronaria

To the Editor,

The diagnostic value of myocardial ischemia tests is influenced by the pretest probability of coronary artery disease, which is essentially determined by the clinical characteristics of chest pain and the age and sex of the patient. It has been suggested that subclinical atherosclerotic carotid artery disease detected by ultrasound might be associated with an increased risk of heart disease. The 2013 ESC guidelines on the management of stable coronary artery disease recommends the use of carotid ultrasound to evaluate the presence of plaque and measure carotid intima-media thickness (CIMT) in patients with suspected coronary disease but without demonstrated atherosclerotic disease (recommendation IIa with level of evidence C).[1] The recommendation is based on expert consensus opinion but is not supported by evidence from specific studies. We wished to investigate whether an increase in CIMT with or without the presence of plaque on a carotid ultrasound performed before an exercise echocardiogram is associated with a positive result.

We studied patients with chest pain referred from the cardiology department of our hospital for exercise echocardiography. Patients with a history of coronary disease or segmental wall-motion abnormalities in the baseline echocardiogram were excluded. CIMT measurements were taken for both carotid arteries over a 1-cm segment in the posterior wall, 1 cm from the bulbs. Mean CIMT values have been shown to provide a better indication of atherosclerotic burden in hypertensive patients,[2] and a CIMT of over 0.9 mm is considered to be a marker of target organ damage.

The exercise echocardiogram was considered to be positive if it induced wall-motion abnormalities in at least 2 contiguous segments.

Fifty-nine patients (mean age, 62.7 years; 59% women) with no history of heart disease were studied. Their characteristics are summarized in the Table. The probability of coronary artery disease based on the manifestations of chest pain and the age and sex of the population was 40% (95%CI, 35.1-46.5). Twenty-seven patients (45%), 16 (59%) of whom were men, had carotid artery disease (CIMT > 0.9 mm with or without plaque). The exercise echocardiogram was positive in 10 patients (16%), 8 of whom were men (80%). No complications were observed during the tests. A positive exercise echocardiogram was significantly associated with carotid artery disease (Figure).

The odds ratio for an association between a CIMT of over 0.9 mm (with or without plaque) and a positive exercise echocardiogram was 6.3 (95%CI, 1.2-33.3). The following factors were also associated with a positive result: a higher pretest probability of coronary artery disease, the presence of typical angina, baseline ejection fraction (> 55% in all cases), prior use of aspirin, and male sex.

Ours is the first study to specifically analyze the ability of CIMT to predict a positive exercise echocardiogram. An association between carotid disease and coronary artery disease has previously been described. While the study in question did not detect an association between carotid disease and exercise echocardiography, the presence of carotid plaque appeared to increase the predictive power of the stress test for diagnosing coronary artery disease.[3] The main limitation of our study is the few patients analyzed and the small number of positive exercise echocardiograms. The sample, however, was large enough to test the hypothesis with sufficient statistical power. Larger studies are needed to further investigate the variables identified as independent predictors of a positive echocardiogram. The results of our study support the recommendations in the 2013 ESC guidelines.[1] While it is known that a positive ischemia test is not synonymous with obstruction of the main epicardial coronary arteries, a negative exercise echocardiogram is associated with good prognosis (1-year mortality of < 1%),[4] and a positive echocardiogram is associated with worse prognosis, even in patients without angiographically significant coronary artery disease.[5]

The findings of a recent study suggest that exercise electrocardiography had little prognostic value in patients with a low pretest probability of coronary artery disease,[6] and standard risk scales have also been claimed to have low predictive power.

In conclusion, CIMT measurement offers additional information, and by modifying the pretest probability of coronary artery