Successful Ablation of an Automatic Rhythm Originating from His Bundle

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Ablación con éxito de un ritmo automático del haz de His

Las taquicardias automáticas de la unión son una rara forma de taquiarritmia supraventricular, con incidencia sobre todo en la edad pediátrica y acompañadas de un mal pronóstico en su evolución espontánea. Presentamos el caso de un paciente de 22 meses de edad con una taquicardia incesante de la unión auriculoventricular con origen en un foco automático localizado en el haz de His o inmediato al mismo. Las aplicaciones de radiofrecuencia con incremento escalonado de temperatura en la misma región del haz de His consiguieron eliminar este automatismo sin complicaciones.


INTRODUCTION

Automatic junctional tachycardias are rare supraventricular tachyarrhythmias observed mainly in infants and children. This arrhythmia has a high mortality rate. We report the case of a 22-month-old infant in which the electrophysiological study disclosed an incessant junctional tachycardia originating from an automatic focus located in the His bundle region. Radiofrequency pulse delivery to the His bundle with controlled progressive heating of this region resulted in a definitive ablation of the ectopic focus without complications.

Key words: Catheter ablation. Tachycardia. Pediatrics. Heart block.

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CLINICAL CASE

22-month-old male child who, coincident with an upper respiratory febrile process, was observed to have notable cardiac arrhythmia on auscultation with the absence of a clinical picture compatible with hemodynamic decompensation, and he was admitted to the hospital. Chest X-ray and echocardiogram were normal. There was no personal or familial history of disease. ECG revealed tachyarrhythmia with an average frequency of 165 beats/minute, made up of narrow irregular QRS complexes with P-waves of sinus origin dissociated from ventricular activity (Figure 1).

An electrophysiological study was performed under local anesthesia, introducing tetrapolar catheters via the right and left femoral vein pathways, one for location in the His bundle (Josephson 4 F) and the other for cartography and ablation (Marinr 5 F, SCXL; 4 mm distal electrode) with radiofrequency via an Atakr source (Medtronic-CardioRhythm) with automatic temperature control. At the beginning of the study a clear reduction in ectopic activity frequency was observed that was attributed to the effects of the general
anesthetic. The intracavity recordings showed the incessant and spontaneous presence of ectopic beats dissociated from atrial sinus activity, in which each QRS complex was preceded by His bundle deflection with a normal HV interval (Figure 2). Occasional sinus capture was observed. Complete ablation-type cartography of the interatrial septum was performed and did not show the existence of retrograde atrial conduction with the exception of the ectopic activity; an earlier electrogram showed the same His bundle deflection. Inhibition of tachycardia was also not observed at any time with mechanical manipulation of the catheters.

A total of 9 applications of radiofrequency were made empirically from the inferoparaseptal region, with applications progressively more anterosuperior and closer to the hisian area (Figure 3). On each application the initial temperature was fixed at 45 °C, with progressive increments of 2 °C to 3 °C up to a maximum of 55 °C if a rapid junction rhythm was not observed within the first 20 seconds of the application or A V block. This triggered a rapid junction rhythm with complete A V dissociation in 5 of the applications from the septal positions (Figure 3A). The superior displacements of the ablation catheter from these positions toward the hisian area were accompanied by a progressive decrease in the presence of ectopy of the junction competing with normal sinus automatism. Thus, applications in the same hisian area definitely abolished the ectopy (Figures 2C and 3C). Following the last 2 applications in the proximity of the major His deflection, development of a right branch conduction disturbance was observed that did not meet the criteria of a complete block (Figure 2C). Following the procedure, normal AV conduction was noted, with the establishment of a Wenckebach point with atrial stimulation cycles of 250 milliseconds and an unchanged HV interval. At 3-month followup, the child remained asymptomatic, with no ectopic activity of the junction and with the disappearance of the conduction disturbance of the right branch.

**DISCUSSION**

Non-paroxysmal automatic tachycardia of the AV junction is an infrequently occurring arrhythmia, initially described in children and infants and constituting less than 1% of all tachycardias. This pediatric form of arrhythmia has a natural history with an elevated mortality rate that reached 35% of the 26 cases in the broad series described by Villain et al, with the cause of death including sudden infant death syndrome and its possible relationship with the myocardopathy that may accompany it. This form of presentation is substantially different from the usually transitory episodes of tachycardia that develop postoperatively in congenital heart disease. We could not pinpoint the exact initiation of tachycardia in our patient, in whom arrhythmia appeared to be an incidental noncongenital finding. The poor prognosis of these forms of arrhythmia at an early age and the known limited response to anti-arrhythmic drugs results in pediatricians recommending radiofrequency ablation as the first therapeutic option before the appearance of signs suggestive of myocardioptathy.

Both the spontaneous and incessant forms of presentation, competing with the sinus rhythm, and their palatine abolition during the ablation procedure imply abnormal automatism as the most probable mechanism for this tachyarrhythmia. The result of radiofrequency lesions in the hisian region suggests that the automatic focus may be made up of transitional perihi-
sian cells or, more likely, the His bundle itself, as the
compact node has been described as lacking automa-
tism. Although retrograde conduction, except for the
ectopic focus, was not observed, there may have been
an occult retrograde penetration of the AV node of the
automatic hisian or perihisian heartbeats, as the AH in-
terval during the few occurrences of sinus capture was
more prolonged (100 milliseconds) than in normal si-
nus rhythm (55 milliseconds) following ablation.

Experience with using radiofrequency ablation this
type of arrhythmias is scarce, and is composed of iso-
lated cases and 1 series of 12 patients in a study by
Hamdan et al. We followed the anatomic strategy
used by this group of researchers in for their cases in
which, like our patient, the ectopic focus did not show
evident retrograde conduction. In these patients they
performed empirical applications in the inferoparasep-
tal area with progressively superior displacement if the
tachycardia persisted. A more novel approach, in our
case, was the step-by-step incremental application of a
fixed temperature that allowed us to increase the sa-
fty margin during the procedure in order to avoid de-
velopment of a possible irreversible AV block in a pe-
diatric patient. Wu et al reported their success in
suppressing an ectopic focus that was also in the area
of the His bundle via the careful application of low do-
ses of radiofrequency energy (10 J). On the other
hand, the application of radiofrequency ablation im-
mediately before the major deflection of the hisian
bundle distances it from the compact node and acts on
the penetrating portion of the His bundle that is pro-
tected by the central fibrous body. Finally, the new cr-
yoablation techniques, with temperatures for carto-
ography of –30 °C that permit complete reversibility of
tissue lesions, are very promising for cases such as
the one we report. At the time we performed our pro-
cedure cryoablation catheters had not yet been desig-
ned for pediatric patients. In any case, our report ar-
gues the case for invasive treatment with progressive
and prudent use of radiofrequency ablation in these
rare cases, in contrast with the much more conserva-
tive positions of other authors.

Fig. 2. In the 3 panels from top to bottom: surface leads I, II, V1 and
V6, in addition to intracavity recordings (amplitude, 0.5 mV/cm) with
the ablation catheter (Abl) and with the proximal (p His) and distal (d
His) ends of the catheter in the area of the hisogram. A) The ectopic
rhythm at the beginning of the study can be observed, with the abla-
tion catheter in the septal position (Figure 3A), with complete AV dis-
sociation and a sinus capture. B) Recording with the ablation catheter
approximately 4 mm below the distal bipole of the His catheter. Note
the presence of minimal hisian deflection (arrows) preceding each
ectopic complex. C) The distal ablation catheter is located immediately
anterior to the distal His catheter in the position from which ectopy
was completely eliminated; only one beat of ectopy was observed in
this sequence. Note the presence of a clear hisian deflection coincident
with the His area. A indicates atrium; H, deflection of the His bundle; V,
ventricle.

Fig. 3. Position of the ablation catheters (arrow heads) and the hisogram recor-
ding (arrows) in the anteroposterior ra-
diologial view. Photograms A, B, and C
reveal the position of the ablation cathe-
ter in the septal region, immediately be-
low the lead with the maximum hisian
deflection and immediately in front of
this deflection, respectively. Each posi-
tion corresponds to the respective intra-
cavity recordings shown in Figure 2.
REFERENCES


