

Original article

Pediatric Catheter Ablation: Characteristics and Results of a Series in a Tertiary Referral Hospital

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ABSTRACT

Introduction and objectives: Catheter ablation has become the treatment of choice in an increasing number of arrhythmias in children and adolescents. There is still limited evidence of its use at a national level in Spain. The aim was to describe the characteristics and results of a modern monocentric series form a referral tertiary care centre.

Methods: Retrospective register of invasive procedures between 2004 and 2016 performed in patients under 17 years and recorded clinical characteristic, ablation methodology and acute and chronic results of the procedure.

Results: A total of 291 procedures in 224 patients were included. Median age was 12.2 years, 60% male. Overall, 46% patients were referred from other autonomous communities. The most frequent substrates were accessory pathways (AP) (70.2%, > 50% septal AP localization) and atrioventricular nodal reentrant tachycardia (AVNRT) (15.8%). Congenital and acquired heart disease was frequent (16.8%). Cryoablation was used in 35.5% of the cases. Overall acute success of the primary procedure was 93.5% (AP 93.8%; AVNRT 100%). Redo procedures after recurrence were performed in 18.9% of all substrates, with a long-term cumulative efficacy of 98.4% (AP 99.3%; AVNRT 100%). One (0.37%) serious complication occurred, a case of complete atrioventricular block.

Conclusions: Our study replicated previous international reports of high success rates with scarce complications in a high complexity series, confirming the safety and efficacy of pediatric catheter ablation in our environment performed at highly experienced referral centers.

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Ablación pediátrica con catéter: características y resultados del procedimiento en un centro terciario de referencia

RESUMEN

Introducción y objetivos: La ablación con catéter es un método para tratar arritmias en población pediátrica indicada en un creciente número de casos. Hay poca evidencia sobre la experiencia en estos procedimientos en España. El objetivo es describir las características y los resultados de una serie contemporánea de un hospital terciario de referencia nacional.

Métodos: Se revisaron los procedimientos de ablación realizados entre 2004 y 2016 en menores de 17 años en el momento de la indicación. Se analizaron características clínicas, metodología de la ablación y resultados agudos y a largo plazo.

Resultados: Se realizaron 291 procedimientos en 224 pacientes (mediana de edad, 12,2 años; el 60% varones). El 46% de los pacientes venían derivados desde otras comunidades autónomas. Los sustratos más frecuentemente abordados fueron las vías accesorias (VAC) (el 70,2%; más del 50% septales) y la taquicardia intranodular (TIN) (15,8%). El 16,8% presentaba cardiopatía congénita, familiar o adquirida. El 35,5% de los casos se realizaron con crioblación. El éxito agudo general de los procedimientos primarios fue del 93,5% (el 93,8% en las VAC y el 100% en las TIN). Se repitieron procedimientos por recurrencia en el 18,9% de los casos, con un éxito acumulado del 98,4% (el 99,3% en las VAC y el 100% en las TIN). Se registró un bloqueo auriculoventricular completo (0,37%), sin otras complicaciones mayores.

Palabras clave:

Ablación con catéter

Cardiopatías congénitas

Crioablación

Pediátrica

Radiofrecuencia

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Conclusiones: El elevado porcentaje de éxito con mínimas complicaciones en una serie con alto nivel de complejidad reproduce los resultados publicados en otros países y refrenda el uso de la ablación con catéter en población pediátrica en centros especializados de referencia.

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Abbreviations

AP: accessory pathway
AVNRT: atrioventricular nodal reentrant tachycardia
FAT: focal atrial tachycardia
MRAT: macroreentrant atrial tachycardia
VT: ventricular tachycardia

INTRODUCTION

Catheter ablation is a safe and effective method for treating arrhythmias in the pediatric population and is considered the treatment of choice for a wide range of clinical situations and patient profiles.¹ Several prospective and retrospective registries have shown a high rate of acute and long-term success and a low risk of serious complications.²⁻⁷ In addition, the increasingly widespread use of electroanatomical mapping and different ablation sources have improved safety and outcomes in complex cases. As a result, the recommendations in the clinical guidelines and expert consensus statements for performing electrophysiological procedures in adults have been extended to the pediatric population worldwide.^{1,8,9}

However, the number of pediatric ablation procedures performed remains relatively low, and their complexity requires a high level of specialization in both pediatric cardiology and electrophysiology.⁸ For this reason, pediatric ablation procedures should be restricted to referral centers with adequate experience and patient volume. Compared with the extensive experience published in other parts of the world, in particular in North America, there are very few published data from Spain.

The aim of this study was to describe the characteristics and outcomes of ablation in a contemporary series of pediatric patients from a single tertiary referral center.

METHODS

Study Sample

A retrospective analysis was performed of the pediatric ablation electrophysiology studies carried out at the study center between January 2004 and December 2016, by the adult electrophysiology group of the cardiology department in collaboration with pediatric cardiologists from the pediatric department. The age limit was 16 years, although second procedures performed in older patients were included. All patients were included, irrespective of their cardiac history, clinical situation, or previous ablation attempts in other centers. Data were collected on demographics such as age, sex, and region of Spain (autonomous community) from which the patients were referred, as well as weight and concomitant congenital heart disease.

Electrophysiological Study and Ablation

Arrhythmogenic substrates were classified as atrioventricular accessory pathway (AP), atrioventricular nodal reentrant tachy-

cardia (AVNRT), focal atrial tachycardia (FAT), macrore-entrant atrial tachycardia (MRAT), ventricular tachycardia (VT), or junctional ectopic tachycardia. The energy source (radiofrequency or cryoablation) and the approach (percutaneous or surgical) were recorded. In cases involving a change of energy source during the procedure, the last source used was recorded. Cryoablation was performed with 4, 6, and 8 mm tips (CryoCath, Medtronic Inc; Minneapolis, Minnesota, United States); when appropriate, the technique was performed with 2 applications, with cryomapping at -30°C followed by cryoablation at -70°C .

The procedures were carried out under general anesthetic. Use of 3-dimensional electroanatomic mapping systems was recorded.

Short-term and Long-term Outcomes

Standard criteria were used to determine the acute success of the procedures. The criterion was the absence of conduction for 30 minutes after the last application in cases of AP and was noninducibility following administration of adenosine and isoproterenol infusion for AVNRT, FAT, MRAT, and VT. For AVNRT, the presence of a nodal echo was accepted.^{4,8} The incidence of recurrence was recorded during protocol-based follow-up in clinic, defined as documented occurrence of the originally-treated arrhythmia and/or recurrence of pre-excitation or the corresponding electrocardiographic changes. Repeat procedures on the same substrate were recorded and the percentage of acute and long-term success was calculated for the primary procedure, as well as the long-term cumulative success of all procedures on the same substrate, defined as the absence of recurrence until the end of follow-up, excluding patients who were not scheduled for further attempts following a failed primary procedure ($n = 10$).

Statistical Analysis

Continuous variables are reported as median [interquartile range], as they did not follow a normal distribution. They were compared using the Mann-Whitney test. Categorical variables are presented as frequency and percentage and were compared using the chi-square test or Fisher exact test. P -values $< .05$ were considered significant. Variables associated with acute failure or postprocedure recurrence were identified on univariate analysis and compared using multivariate logistic regression with stepwise selection or exclusion of variables. Stata 14.0 was used.

RESULTS

Baseline Characteristics and Indications

Between January 2004 and December 2016, 291 ablation procedures were performed in 224 patients; 60% were male, and the median follow-up was 6 [2-10] years. Demographic data are shown in Table 1. The mean age was 12.2 [9.1-15.1] years; 11.4% of patients were aged ≤ 5 years and 5 patients were aged < 2 years. Patients with FAT or junctional ectopic tachycardia were significantly younger than those in the other groups (median age, 6.0 and 7.6 years, respectively; $P < .001$). Only 4.7% of AVNRT procedures were conducted in patients aged 5 or younger. The

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