

TRANSTELEPHONIC ECG VERSUS ELECTROPHYSIOLOGIC STUDY IN CHILDREN WITH RECURRENT PALPITATION ATTACKS*

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SUMMARY: Çeliker A, Tokel K, Medikoğlu M, Özme Ş. (Cardiology Unit, Department of Pediatrics, Hacettepe University Faculty of Medicine, Ankara, Turkey). Transtelephonic ECG versus electrophysiologic study in children with recurrent palpitation attacks. Turk J Pediatr 1997; 39: 45-50.

Palpitation may be a terrifying event for children and pose diagnostic problems for pediatric cardiologists. Routine methods often fail to document episodic arrhythmia because the episodes may be brief or infrequent or both.

The purpose of this study was to evaluate and compare values of non-invasive and invasive techniques. Twenty-three children (mean age 11.7 ± 2 years, range 7-16 years) with recurrent palpitation attacks (> 2 times), who had normal physical examinations, ECG, echocardiography, 24 hour ambulatory ECG monitoring and treadmill exercise tests, were included in the study. Redline^R Model CG 4000 TTE recorders were given to patients for 10 or 20 days. We performed an intracardiac electrophysiologic study (EPS) on 14 patients. The mean number of palpitation attacks was 11.3 ± 7.4 (median: 5), lasting 9.6 ± 7 (median 3) minutes. The number of transmitting records was 2 ± 1.4 (1-20). Of the 23 patients, only 15 (65%) transmitted during the palpitation attacks. Twenty-four-hour ambulatory ECG monitoring findings were normal in all patients. One patient had a wide QRS tachycardia attack in the TTE records. We stimulated ventricular tachycardia in the same patient in the EPS. Among the other patients who transmitted TTE records during palpitation attacks, we diagnosed two cases of concealed accessory pathway and eight cases of dual AV nodal pathway in the EPS. In conclusion, TTE is a sensitive and accurate method for diagnosis and follow-up of patients with cardiac arrhythmia. It can be used before invasive studies in children with recurrent palpitation attacks.

Key words: transtelephonic ECG, palpitation, electrophysiologic study, children.

Palpitations are forceful pulsations of the heart that are perceptible to the patient, usually accompanied by an increase in rate and sometimes by irregularity in rhythm. The complaint of palpitations does not necessarily imply the presence of heart disease or a specific arrhythmia¹. Children without previous evidence of heart disease are frequently referred to a pediatric cardiologist for evaluation of symptoms of palpitations. It is sometimes difficult to evaluate the cause of this symptom. Electrocardiographic documentation during symptoms may be of considerable diagnostic value in patients with suspected paroxysmal arrhythmias.

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There may be no finding on physical examination, routine 12-lead electrocardiography (ECG) records or 24-hour ambulatory ECG monitoring if symptoms are infrequent¹⁻³. For these reasons, new diagnostic tools are being used for the evaluation of recurrent palpitation attacks. Transtelephonic monitoring may be helpful in certain situations, as the monitoring period may be extended indefinitely⁴⁻⁶. Invasive studies, such as trans-esophageal atrial pacing and intracardiac electrophysiologic studies (EPS), have proved valuable in the diagnosis and treatment of cardiac rhythm disturbances^{2,7}. The purpose of this study was to evaluate and compare the values of non-invasive and invasive techniques.

Material and Methods

Twenty-three children with recurrent palpitation attacks (> two times) were evaluated between February 1993 and March 1994. All patients had normal physical examinations, complete blood count, routine 12-lead ECG recordings, echocardiography, treadmill exercise testing, serum T3, T4 and TSH, and 24-hour ambulatory ECG monitoring (Table I).

Table I: Epidemiologic Data of Patients

Age of patients	11.7 ± 2 years (range 7-16)
No. of palpitation attacks	11.3 ± 7.4 (median 5 attacks)
Duration of palpitation attacks	9.6 ± 7 (median 3) minutes
Ten-day TTM	13 cases
Twenty-day TTM	10 cases
No. of transmissions	2 ± 1.4 (range 1-10, median 2)

TTM: transtelephonic monitoring.

Transtelephonic ECG Monitoring

Each patient was provided with a transmitter (Redline Model CG 4000 TTM). The system consisted of a small, clip-on, portable recorder unit attached to under-arm electrodes placed at the time of symptoms. The patients or their parents were asked to transmit their electrocardiograms during typical palpitation episodes. All transmitted electrocardiograms were reviewed by a physician for evidence of arrhythmia at the time of transmission. If any abnormality was detected, the referring physician (A.Ç. or K.T.) was contacted immediately for further evaluation.

The monitoring period was 10 days if a transmission was possible during palpitation attacks. If the patient did not transmit electrocardiograms, the recorder was kept for 20 days.

Electrophysiological Study

We performed intracardiac EPS on 14 patients whose parents agreed. Diazepam (0.01 mg/kg) was administered intravenously to each patient two minutes before

cardiac catheterization. Three bipolar or quadripolar catheters were inserted percutaneously into one or both femoral veins and were positioned in two or three of the following areas: 1. the high right atrium near the sinoatrial node, 2. across the tricuspid valve orifice to record the low septal right atrial and His depolarizations, and 3. the right ventricular apex.

At the beginning of the study, sinus node functions (sinus node recovery time, and sinoatrial conduction time), atrioventricular conduction (the duration between atrial electrocardiogram and His bundle deflection: AH; the duration between His bundle deflection to the beginning of ventricular activation: HV; and the Wenckebach point) and ventriculoatrial conduction were determined. Atrial and ventricular programmed stimulation was performed at 600, 500, and 430 msec pacing lengths for eight beats with one and two extra stimuli. Then we tried to stimulate tachycardia with burst stimulation. All of these studies were repeated after an intravenous atropine bolus (0.04 mg/kg) if supraventricular tachycardia had not been induced.

Results

During a 13-month period, 23 children and adolescents suffering from recurrent palpitation attacks were evaluated. Their ages ranged from seven to 16 years (mean: 11.7 ± 2). The mean number of palpitation attacks was 11.3 ± 7.4 (range 3-22). We noted more than five attacks in nine patients (Table I). The duration of palpitation attacks was 9.6 ± 7 minutes (median 3 minutes).

Of the 23 patients who received transtelephonic monitors, 15 (65%) attempted to record and transmit during their monitoring period. Fifteen patients who transmitted records during a palpitation attack had normal 24-hour ambulatory monitoring records. One patient had a wide QRS tachycardia attack in the TTE record (Table II).

Table II: Twenty Four Hour Ambulatory Monitoring and TTE Record Findings in Patients' Transmitting Records During Palpitation Attacks

Findings	24 h Ambulatory Monitoring n = 23	TTE records n = 15
Sinus rhythm	11	10
Sinus tachycardia	4	4
Wide QRS tachycardia	—	1

The findings of the intracardiac electrophysiologic study are shown in Table III. Eight patients had dual atrioventricular nodal physiology, and we could not induce supraventricular tachycardia (SVT). Two patients with concealed atrioventricular conduction were followed without SVT attacks for 15 and 17 months. These patients were monitored very closely with frequent 24-hour ambulatory ECG monitoring. Eight patients who transmitted records during palpitation attacks were evaluated by intracardiac electrophysiologic study (Table IV). Ventricular tachycardia was induced in one patient with wide QRS tachycardia in the TTE record.

Table III: Electrophysiologic Findings in Children with Recurrent Palpitation Attacks

Findings	n	%
Dual AV nodal pathway	8	57.0
Concealed atrioventricular conduction	2	14.3
Induced ventricular tachycardia	1	7.1
Wenckebach point decreased	1	7.1
Normal EPS	3	21.3

Table IV: TTE and EPS Findings of Patients with Transmitting Records During Palpitation Attacks

Age	No. of palpitation attacks	TTE findings	EPS findings
10	8-10	Wide QRS tachycardia	Induced ventricular tachycardia
9	4	Sinus rhythm	Concealed accessory pathway
14	5-6	Sinus tachycardia	Concealed accessory pathway
14	20-25	Sinus rhythm	Dual AV nodal pathway
16	20-25	Sinus rhythm	Dual AV nodal pathway
16	5-6	Sinus rhythm	Normal EPS
12	3-4	Sinus rhythm	Normal EPS
7	20	Sinus tachycardia	Normal EPS

Discussion

Documentation of paroxysmal, brief and/or infrequent cardiac arrhythmias with palpitation attacks presents a frustrating problem to the pediatric cardiologist. The specific diagnosis and appropriate management depend on electrocardiographic confirmation⁵. Although the treadmill exercise test and 24-hour ambulatory monitoring have been used to detect arrhythmias, their sensitivities are low in patients without documented tachycardia^{8,9}. In our study we did not detect any arrhythmia in patients with palpitation during 24-hour ambulatory monitoring. During the monitoring period, only three patients (13%) experienced palpitation attacks, all of which were sinus tachycardia. There is consensus that the greatest utility of ambulatory electrocardiography is in the area of arrhythmia assessment⁹. Twenty-four-hour ambulatory monitoring was also more effective in detecting nonsense and asymptomatic events among high-risk children such as postoperative patients and known cardiac arrhythmias related to congenital heart disease¹⁰.

Outpatient transtelephonic electrocardiographic monitoring for transient event recording has been recommended for the evaluation of both adult and pediatric patients with infrequent symptoms^{4-6, 10}. Sixty-five percent of our patients succeeded in sending TTE transmissions during their clinical symptoms, which is comparable to previously reported rates^{4-6, 10}. We found that transtelephonic monitoring often provides reassurance of the absence of an arrhythmia during

symptoms. Four patients (26.6%) transmitted ECG records during symptoms, and these were sinus tachycardia. The most important data we obtained was a wide QRS tachycardia in a patient's TTE records, but his 24-hour ambulatory monitoring was normal.

In a previous report, the utility of transesophageal pacing in the evaluation of young patients with palpitations has been demonstrated^{2, 11}. Pongiglione et al.² demonstrated that transesophageal atrial pacing frequently (71%) induced a short bout of tachycardia, which may be the cause of symptoms in young patients with a history of palpitations and other evidence of heart disease. They did not induce any sustained tachycardia lasting more than one minute. We did not find any article about intracardiac EPS in children with recurrent palpitations and no documented arrhythmia. We induced ventricular tachycardia in only one patient who had wide QRS tachycardia in the TTE during a palpitation attack. Compared to previous studies, our supraventricular tachycardia induction results seem low. This may be partially explained by the lack of isoproterenol infusion during atrial pacing. We found dual atrioventricular nodal physiology in eight patients, which is a common finding in the normal population¹¹. Two patients with concealed atrioventricular conduction excluding the atrioventricular node did not experience any supraventricular tachycardia attacks during follow-up. However, there was no arrhythmia in these patients' TTE records. We did not induce tachycardia in the other seven patients with transmitting records during palpitation attacks, nor in the six patients without records during palpitation attacks.

In conclusion, 24-hour ambulatory monitoring is insufficient in children with recurrent palpitation attacks, while TTE monitoring is a sensitive and accurate method for diagnosis of arrhythmia. Transtelephonic monitoring may be valuable in demonstrating the absence of an arrhythmic basis for a patient's palpitation as well as in documenting the arrhythmia responsible for those palpitation attacks. Transtelephonic ECG can be used before invasive studies in children with recurrent palpitation attacks. If the palpitation attacks originate from sinus tachycardia and if there is no arrhythmia, invasive evaluation of the patient is unnecessary.

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