Premature ventricular contractions in normal children

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Premature ventricular contractions (PVCs) are frequently seen in children with normal cardiac findings. The purpose of this study was to evaluate the characteristics and the prognosis of PVCs in children with normal heart.

This study included 149 children with PVC who did not have systemic or cardiac disease. Their median age at diagnosis was 10 years (range 1 month to 17 years). Seventy-six children (51%) were symptomatic. Most of the patients had unifocal PVC, whereas 5 (3.1%) of them had multifocal PVCs. The patients were evaluated by repeated Holter recordings and exercise test.

In the first Holter monitoring recordings, PVCs were in the form of isolated PVC in 122 (82%) patients, couplet-triplet in 14 (9%) patients and nonsustained ventricular tachycardia in 13 (9%) patients. The exercise test was performed in 105 (70.5%) patients. The frequency of PVCs decreased and disappeared in 65 (61.9%) children, increased in 8 (7.6%), and were unchanged during exercise in 32 (30.5%). There was no difference between the groups according to exercise response regarding PVC quantity.

Fifty-two of 149 children (35%) were followed up for a median period of 22 months. After follow-up, PVCs of 25 of the 52 patients (48.1%) decreased and disappeared. We did not find any correlation between the frequency of PVC and treatment, age, gender or the PVC frequency decrease with exercise.

In conclusion, PVCs in normal children have benign prognosis and during follow-up a considerable percent show improvement.

Key words: premature ventricular contractions, 24 hour ambulatory ECG monitoring, exercise test.

Premature ventricular contractions (PVC) are characterized by the premature occurrence of a QRS complex that is abnormal in shape and duration. They can be produced by direct mechanical, electrical, and chemical stimulation of the myocardium[1]. PVCs are frequently seen in children with normal cardiovascular findings. They have been evident on routine electrocardiograms (ECGs) in 0.8 to 2.2% of children with no known heart disease, in 18% of newborns and in up to 50% of adolescents during 24-hour ambulatory ECG monitoring[2-4]. The purpose of this study was to evaluate the characteristics and the prognosis of the PVCs in children with normal cardiovascular system.

Material and Methods

The study group consisted of 149 children with PVCs admitted to the Pediatric Cardiology Department of Hacettepe University Hospital between January 1994 and June 2003. The patients did not have a systemic or cardiac disease. The diagnosis was accomplished by auscultation and ECG in 130 (87.2%) patients and by Holter monitoring in 19 (12.8%). The median age of the study group was 10 years (1 month-17 years). Sixty-seven of 149 patients (45%) were female and 82 (55%) were male. Twenty-four hour Holter monitoring in all and exercise test in 105 (70.5%) cooperating patients using modified Bruce treadmill testing were performed. Seventy-three patients (49%) were asymptomatic while 76 (51%) were symptomatic at diagnosis. The complaints of the patients were palpitation, chest pain, syncope and dyspnea. Patients were divided into groups according to the electrocardiographic pattern (isolated PVCs, couplet-triplet or nonsustained ventricular tachycardia-NSVT) and morphology (unifocal or multifocal) of the

PVCs. PVCs of patients were also evaluated with the Lown-Wolff classification. Patients who were symptomatic and/or whose ventricular ectopies were complex according to Lown-Wolff classification were given treatment, including beta blockers, calcium channel blockers, propafenone and amiodarone. Fifty-two of 149 children were followed up for a median period of 22 months (6-112). The prognosis of the patients was evaluated after the follow-up period according to results of the 24-hour Holter monitors. Electrophysiological study and radiofrequency ablation were performed in some patients with NSVT.

The group values were expressed as medians. Contrasts between two and three groups were done by Mann-Whitney test and Kruskal Wallis, respectively. Differences between groups for categorical variables were determined by the χ^2-test. For all statistical tests, a two-tailed p-value of ≤ 0.05 was considered to be significant.

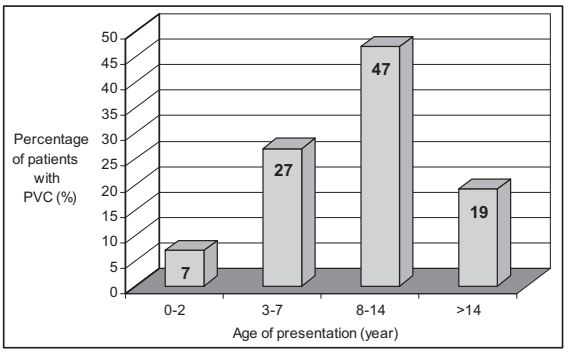

Fig. 1. Distribution of patients with PVC according to the age at presentation.

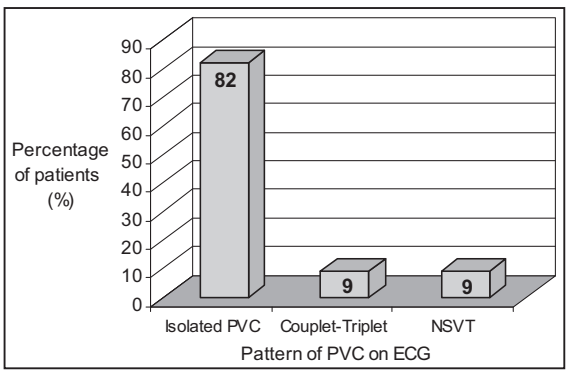

Fig. 2. Distribution of patients with PVC according to the age at presentation.

Results

Characteristics of the 149 patients with PVC are shown in Table I. Most of the patients were diagnosed between the ages of 8-14 (Fig. 1). In the first Holter monitoring recordings, PVCs were in the form of isolated PVC in 122 (82%) patients, couplet-triplet in 14 (9%) patients and NSVT in 13 (9%) patients (Fig. 2).

The morphology of the PVCs was unifocal in 144 (96.6%) and multifocal in 5 patients. Median PVC in an hour (PVC/hr) was 222. This value was higher in the 3-7 age group (303 PVC/hr) and lower in the adolescent age group (41 PVC/hr). The median PVC/hr value in the isolated PVC group was 165, in the couplet-triplet group was 552, and in the NSVT group was 1166. The PVC/hr value was lowest in the isolated PVC group ($p<0.05$).

The exercise test was applied to 105 cooperating patients. PVCs disappeared in 36 patients (34.3%), while PVC frequency decreased in

Table I. Characteristics of Patients with PVC at Presentation

Patients with premature ventricular contractions (PVC)	
Patient number	149
Age (month) (median value)	120 (1-204)
Gender (M/F)	67 (45%) / 82 (55%)
Symptomatic patients	76 (51%)
Morphology of the PVC (unifocal/multifocal)	156 (96.9%) / 5 (3.1%)
Additional arrhythmia (supraventricular ectopy)	27 (18.1%)
Duration of follow-up (month) (median value)	22 (6-120)
Treatment	32 (21.5%)
Complications (NSVT)	13 (8.7%)
Electrophysiologic study	10 (6.7%)
Radiofrequency ablation	2 (1.3%)

NSVT: Nonsustained ventricular tachycardia.
PVC : Premature ventricular contractions.

29 patients (27.6%), increased in 8 patients (7.6%), and was unchanged with exercise in 32 patients (30.5%). Exercise test results did not differ according to the PVC degree.

Fifty-two patients with follow-up were evaluated to determine the prognosis. Their characteristics and the classification of PVCs according to Lown–Wolff classification are shown in Tables II and III, respectively. Median PVC/hr value decreased from 337 to 144 during follow-up ($p>0.05$). The initial and the last PVC/hr in the three age groups did not differ statistically ($p>0.05$). There was no significant difference regarding electrocardiographic PVC patterns. The PVC/hr frequency was significantly decreased in exercise responders. There was no statistical difference between the groups divided according to treatment regarding PVC/hr values ($p>0.05$).

Thirty-two of 149 patients and 19 of 52 patients with follow-up were given therapy. After follow-up, 16 of 52 patients were using drugs given for treatment.

Ventricular tachycardia (VT) was induced in 4 out of 10 patients (40%) by electrophysiological study. Radiofrequency ablation therapy was performed in 2 of the 4 patients in whom VT was induced.

Discussion

Premature ventricular contractions (PVCs) occur commonly and are one of the most common causes for an irregular pulse in a young patient. They are generally diagnosed during physical examination and with electrocardiography or Holter monitoring. All children who have PVCs or ventricular arrhythmias should be evaluated for probable heart disease. In the present study,

Table II. Characteristics of the Patients with Follow-Up

Evaluation parameters		Number of patients	Frequency of PVC (median PVC/hour) Initial	Last (After the follow-up period)	p value
Gender	Female	26	301	274	>0.05
	Male	26	416	18	>0.05
Age at diagnosis	3-7	16	502	350	>0.05
	8-13	30	327	11	>0.05
	14-17	6	486	33	>0.05
Pattern of PVC on ECG	Isolated PVC	37	456	245	>0.05
	Couplet-triplet	9	436	23	>0.05
	NSVT	6	1237	966	>0.05
Response to exercise (Exercise test)	Decreased and disappeared	33	502	255	<0.05
	Increased	4	383	672	>0.05
Medication	–	33	324	245	>0.05
	+	19	436	23	>0.05
Total patients		52	337	144	>0.05

PVC: Premature ventricular contractions, NSVT: Nonsustained ventricular tachycardia.

Table III. Distribution of PVCs of Patients with Follow-Up According to Lown-Wolff Classification

	Lown-Wolff class	0	I	II	III	IVA	IVB
Number of patients	According to the first Holter recordings	–	6 (11.5%)	33 (63.5%)	2 (3.8%)	6 (11.5%)	5 (9.6%)
	According to the last Holter recordings	16 (30.8%)	8 (15.4%)	25 (48.1%)	–	2 (3.8%)	1 (1.9%)

approximately half of the patients with PVC were asymptomatic. Asymptomatic patients were diagnosed during the physical examination and with electrocardiography. The most frequent symptoms at diagnosis were palpitation and chest pain. Hypotension/syncope and dyspnea were observed less frequently.

In Tsuji et al.'s[5] study, the average age at diagnosis was between 6 and 12. Our study was similar, with diagnosis most common between 8-16 years of age. Complexity of ventricular ectopy has prognostic value especially in patients with ischemic heart diseases. Thus, Lown classification was defined in order to classify the PVCs[6]. According to this classification, PVCs that are multifocal, the salvos and 'R on T phenomenon', were considered as complex ventricular ectopy. In our study, the complex ventricular ectopy constituted 25% and 5.8% of PVCs at the initial and at the last Holter monitoring, respectively, demonstrating that complex ventricular ectopy also decreased over time.

Exercise test is important for evaluating premature ventricular beats. Ventricular ectopy is considered as benign when it is suppressed during exercise. In our study, the frequency of PVCs decreased or disappeared during exercise in 62% of the patients and there was no difference regarding PVC quantity. Kennedy et al.[7] in their study evaluated the patients who had complex ventricular ectopy and they observed that the PVCs disappeared with exercise in 21 out of 23 patients. According to their study and ours, we can say that the change in the frequency of PVCs during exercise test does not depend on the complexity of the PVCs.

Premature ventricular contractions (PVCs) are frequent in children, but VT is rare. In the study of Davis et al.[8], 40 patients with VT who were under 5 years and who did not have predisposing heart disease were evaluated. Cardiomyopathy, myocarditis, myocardial neoplasia and myocardial fibrosis were observed in 20 out of 40 patients. In our series, there were 13 patients (8.7%) with NSVT and there was no predisposing heart disease. Sudden unexpected death was not reported in patients with PVCs. There was also no mortality related with PVC in our study.

Twenty-four hour Holter monitoring is the most important method to show the severity of ventricular ectopy. In the study of Morganroth et al.[9], the variations in the PVC frequency of 15 patients were evaluated and they determined that there should be more than 83% decrease in order to say that the decrease in the frequency of the PVC was because of the treatment rather than biological or spontaneous. Considering this study, the children whose PVC frequency decreased constituted 48% of the patients with follow-up in our study.

Yabek[10] said that all children with ventricular ectopy should at least undergo electrocardiography, echocardiography and an exercise test. He added that simple PVCs constituting ventricular bigeminy and trigeminy need not be routinely followed by a cardiologist if the results of these tests are normal, but children with multiform PVC and couplet should also have 24-hour ambulatory electrocardiography and should be followed periodically by a pediatric cardiologist even if they have a structurally normal heart. In our study, the children with couplet and triplet had similar ratio of decrease and disappearance in their PVC frequency. Hence, we think that all patients with PVC should be followed routinely regardless of their PVC pattern.

In the absence of cardiac or systemic disease, most of the PVCs are benign and prognosis is fairly good. Pattern of the ventricular ectopy has no effect on the prognosis. Most do not require treatment. However, because of the risk of VT, we should perform electrocardiography, echocardiography, 24-hour ambulatory monitoring and exercise test for every pattern of ventricular ectopy and we should follow the children with PVC regardless of the ventricular ectopy pattern.

In conclusion, every child with PVCs should be evaluated by 12-lead surface ECG, echocardiogram, and 24-hour Holter monitoring, and with exercise test in suitable patients. During follow-up, PVCs in normal children may disappear or decrease in time.

REFERENCES

1. Silka MJ, Garson A Jr. Ventricular arrhythmias. In: Gillette PC, Garson A Jr (eds). Clinical Pediatric Arrhythmias. Philadelphia: WB Saunders Company; 1999: 121-145.
2. Nagashima M, Matsushima M, Ogawa A, et al. Cardiac arrhythmias in healthy children revealed by 24-hour ambulatory monitoring. Pediatr Cardiol 1987; 8: 103-108.
3. Southall DP, Richards J, Mitchell P. Study of cardiac rhythm in healthy newborn infants. Br Heart J 1980; 43: 14-20.

4. Brodsky M, Wu D, Denies P, Kanakis C, Rosen KM. Arrhythmias detected by 24-hour continuous ambulatory monitoring in 50 male medical students without apparent heart disease. Am J Cardiol 1977; 39: 390-395.
5. Tsuji A, Nagashima M, Hasegawa S, et al. Long-term follow-up of idiopathic ventricular arrhythmias in otherwise normal children. Jpn Circ J 1995; 59: 654-662.
6. Lown B, Calvert AF, Armington R, Ryan M. Monitoring for serious arrhythmias and high risk of sudden death. Circulation 1975; 52(Suppl): III189-198.
7. Kennedy HL, Underhill SJ. Frequent or complex ventricular ectopy in apparently healthy subjects. A clinical study of 25 cases. Am J Cardiol 1976; 38: 141-148.
8. Davis AM, Gow RM, McCrindle BW, Hamilton RM. Clinical spectrum, therapeutic management, and follow-up of ventricular tachycardia in infants and young children. Am Heart J 1996; 131: 186-191.
9. Morganroth J, Michelson EL, Horowitz LN, Josephson ME, Pearlman AS, Dunkman WB. Limitations of routine long-term electrocardiographic monitoring to assess ventricular ectopic frequency. Circulation 1978; 58: 408-414.
10. Yabek SM. Ventricular arrhythmias in children with an apparently normal heart. J Pediatr 1991; 119: 1-11.