

# Paroxysmal Supraventricular Tachycardia on Children: Clinical Analysis of 37 cases

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**ABSTRACT Objective:** To investigate the curative effect of different methods on treating paroxysmal supraventricular tachycardia of children. **Methods:** 37 cases were retrospective analyzed with regard. The conversion rates of propafenone and amiodarone were analysis by chi-square test,  $\alpha=0.05$ . **Results:** Of 37 children, 13 cases had automatic conversion after curing the primary disease, 24 cases were given propafenone, 1 case gave up, 5 cases had no effect. The propafenone conversion rate was 69.77%. 5 cases with amiodarone, 1 case died of dilated cardiomyopathy, 1 case cured by Radiofrequency ablation after controlling clinical symptoms, the amiodarone conversion rate was 75%. There was no significant difference between them. **Conclusion:** The propafenone and amiodarone all had better conversion rate in children with paroxysmal supraventricular tachycardia, For the complexity and intractable paroxysmal supraventricular tachycardia, radiofrequency catheter ablation was become the best choice for the pediatric patients.

**Key words:** Paroxysmal supraventricular tachycardia; Clinical manifestation; Treatment; Cardioversion

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## Introduction

Paroxysmal Supraventricular Tachycardia(PSVT) is the most common tachyarrhythmia, which could attack in childhood<sup>[1,2]</sup>. It is mainly episode in myocardial, cardiomyopathy, pulmonary heart disease wolff-parkinson-white syndrome etc and also presents in healthy children. The clinical characteristics of paroxysmal episodes will lead to heart failure, even cardiogenic shock if no treatment in time. Some reports indicated, if the PSVT in children episode last more than 8 hours, the risk of heart failure would increased more greatly<sup>[3]</sup>. All kinds of PSVT can episode on childhood. At present, the treatment includes: vagal maneuvers, drugs, electric shock, trans-esophageal atrial pacing (TEAP), and radiofrequency catheter ablation (RFCA). However, vagal maneuvers has poor effect, the TEAP or RFCA often used in complex and challenging PSVT, nevertheless it is often limited because of complicated operation. Thus, drugs are still the main method for treatment of PSVT<sup>[4]</sup>. At present, propafenone was often used, and there was little report about amiodarone which was used in treating pediatric PSVT. Now retrospectively analysis was used on the clinical manifestation and treatment of 37 cases with PSVT in pediatrics Affiliated Hospital of medical college Qingdao University from 2002.04-2011.05.

## 1 Material and Methods

### 1.1 General Information

37 cases who had Paroxysmal Supraventricular Tachycardia

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were selected from hospital inpatients from 2002.04-2011.05, with male 21 cases (56.76%), and female 16 cases (43.24%). Ranging in age from 1 day to 14 years old, the mean age ( $5.48 \pm 4.36$ ), among of them, the newborn 7 cases (18.92%), ~1 year old 2 cases (5.41%), ~3 year old 5 cases (13.51%), ~7 year old 12 cases (32.43%), ~14 year old 11 cases (29.73%). The average weight ( $23.70 \pm 17.48$ )Kg.

### 1.2 Clinical Manifestation

Of 37 cases with PSVT, during the episode, crying 5 cases (13.51%), poor response 3 cases (8.10%), syncope 1 case (2.70%), fever 10 cases (27.02%), refusing foods 7 cases (18.92%), cough 4 cases (10.81%), vomiting 10 cases (20.02%), suffocating 3 cases (8.10%), shortness of breath 6 cases (16.22%), sweating 6 cases (16.22%), nausea 6 cases (16.22%), abdominal pain 3 cases (8.10%), chest pain 3 cases (8.10%), frowsty of bosom 10 cases (27.02%), flustered 12 cases (32.43%), dizzy 3 cases (8.10%), cyanosis 6 cases (6.22%), feeble and lazy 6 cases (16.22%), depression 14 cases (37.84%), pale 5 cases (13.51%), limbs cool 2 cases (5.41%). Physical examination: polycardia obviously 16 cases (43.24%):150-280 times/min, breathing 40 times/min 5 cases (13.89%).

### 1.3 The main causes

Of 37 cases: upper respiratory tract of infection 5 cases (13.51%), atrial septal defect postoperation 1 case (2.70%), tetralogy of Fallot postoperation 1 case (2.70%), interventricular septal defect repair postoperation 1 case (2.70%), patent foramen ovale 2 cases (5.40%), myocarditis 9 cases (24.32%) (viral myocarditis 7 cases, viral myocarditis with pneumonia 1 case, explosive myocarditis with heart failure 1 case), isolated hematuria 1 case (2.70%), coronary sinus expansion 2 case (5.40%), dilated cardiomyopathy 3 cases(8.11%).

### 1.4 Auxiliary examination

**1.4.1 Electrocardiogram** 26 cases in hospital took ECG or 24

Holter ECG, nodal tachycardia 11 cases (42.31%)( a transient sinus tachycardia 2 cases), paroxysmal supraventricular tachycardia 4 cases (15.38%), pre-excitation syndrome 3 cases (11.53%), pre-excitation syndrome with left bundle branch block 1 case (3.85%), atrial tachycardia 9 cases (34.62%)(transient atrial tachycardia 7 cases).

**1.4.2 Echocardiogram** 31 cases in hospital took heart Doppler ultrasound, mitral regurgitation 7 cases (9.68%), mild 4 cases, mild-moderate 2 cases, severe 1 case), tricuspid valve regurgitation 4 cases (12.90%) (mild-moderate 1 case, severe 2 cases), the whole cardiac dilatation 2cases (6.45%), left atrial enlargement 1 case (3.23%), both atrial sinistrum and ventriculus sinister dilatation 1 case (3.23%), cardiac atrium enlargement mildly 1 case (3.23%), patent oval foramen 6 cases (19.36%), coronary sinus expansion 2 cases(6.45%), pulmonary hypertension 3 cases(9.68%), repair of ventricular septal defect 2 cases (6.45%), atrial septal defect (ostium secundum) 3 cases (9.68%), left ventricular systolic function decreases 2 cases (6.45%), hydropericardium 1 case (3.23%), not trouble found 12 cases(38.71%).

**1.4.3 Myocardial enzyme** 32 cases took myocardial enzyme test, lactate dehydrogenase 251- 864 U /L 12 cases (37.50%)( normal:100 ~235U /L), phosphocreatine kinase 150-184U/L 5 cases (15.63%)( normal: 15-130U/L), phosphoricreatine kinase isozyme 40-202U/L 5 case (15.63%)(normal: 0-25U/L).

**1.5 Treatment**

During being in hospital, oxygen was gave, ECG monitor, primary diseases were treated actively, at the same time propafenone (propafenone group) 1-2mg/(kg.time)+GS20ml was given, stop when the heart had sinus rhythm which always presented after injected 5-10 minutes. If fail, there were 3 times at most to push again after 15-30 minutes, the total doses ≤ 6mg/kg. Or gave

oral propafenone 2.5-5mg/ (kg·d), and kept maintenance therapy (oral prapafenone 2-3mg/(kg·d)) after succeed. When prapafenone had no effect, amiodarone 2.5-5mg/(kg·time)+GS20ml was given, intravenous pushed slowly, conversion always in 5-10 minutes, or took 10-15mg/ (kg·d) by oral, kept maintenance therapy (3-5 mg/(kg·d) by oral) after cardioversion.

**1.6 Cardioversion standards**

Propafenone group: conversion in 1 hour and no recurrence in 3 hours were described as effective, otherwise failed. Amiodarone group: conversion in 2 hours was described as effective, otherwise failed.

**1.7 Statistical method**

Calculated the percentage of succeed times of each group, and the data was analyzed with chi-square test method by SPSS17.0 software.

**2 Results**

Of 37 cases, 13 cases had conversion automatically when cured primary disease. 24 cases took propafenone treatment, 1 case gave up treatment on account of recurrent episodes, and 5 cases with recurrent episodes changed propafenone by amiodarone, 17 cases had sinus rhythm at last. 15 cases had slowly intravenous push, succeed in 1 time 2 cases (13.33%), 2 time 6 cases (40%), 3 time 2 cases(13.33%), 4 time 3 cases(20%), 5 time 2 cases(13.33%), the total time of inject propafenone were 43 , succeed 30 times, the rate of conversion was 69.77% . In amiodarone group, 1 case died in primary disease (DCM), 1 case cured by RF-CA for recurrence, 3 cases succeed, the total time were 4, 3 cases had effect, the rate is 75%. And there was no significant difference between the conversion rate of two groups (P>0.05)(Table 1).

Table 1 The comparison of conversion rate between propafenone group and amiodarone group

Group	Positive number	Negative number	Total	Positive (%)
Propafenone group	30	13	43	69.77
Amiodarone group	3	1	4	75
Total	33	14	47	70.21

Note  $\chi^2=0.048$  P>0.05.

**3 Discussion**

Paroxysmal Supraventricular Tachycardia (PSVT) is the most common tachyarrhythmia, which could episode in childhood. It is mainly episodes in myocardial, cardiomyopathy, pulmonary heart disease, wolff-parkinson-white syndrome etc and also in healthy children. Furthermore, the children heart conduction system did not develop so much mature, it was very obvious when the children younger, also contained atrioventricular by-pass reentrant tachycardia, but when the system matured, and by-pass disap-

peared, the PSVT was always self-healing. In this sample, the upper respiratory tract infection 5 cases, myocarditis 9 cases, among of them, PSVT of 8 cases disappeared when cured primary disease, which was identical with infection and age were the causes of children PSVT. On the other hand, 11 cases had congenital heart disease (CHD), 3 cases acquired after CHD neoplasty, the other 8 cases acquired when they were borned. Therefore CHD neoplasty and congenital had much more relationship on the PSVT. In the clinical feature, no-cardiovascular system symptoms were more common, and it was no specificity, especial the

neonates. In this study, 9 cases(24.32%)  $\leq$  1 year, poor response 3 cases (8.10%), vomiting 10 cases (20.02%), refusing foods 7 cases (18.92%), abdominal pain 3 cases (8.10%), chest pain 3 cases (8.10%), all this symptoms may attract the attention of the clinician, and make them avoid misdiagnosis, if EKG was used logically, there was no hard to make a definite diagnosis.

The clinical characteristics of paroxysmal episodes will lead to heart failure, even cardiogenic shock if there was no treatment in time. The mechanism of PSVT including: atrioventricular nodal reentrant tachycardia (AVNRT), atrioventricular reentrant tachycardia (AVRT), the later was very common in children. The persistence of episode depends on the all transmit time of reentrant circuit and more time than effective refractory period (ERP) of tissue. Therefore, if the ERP of tissue reentrant circuit is longer than the total of conduction time, the attack was terminated. At present, the treatment including: vagal maneuvers, drug, electric shock, Trans-esophageal atria pacing (TEAP), and radiofrequency catheter ablation (RFCA) on basis of treating on primary disease. Vagus stimulation operation was simple but had poor effect. TEAP or RFCA often only used in complex and challenging PSVT, nevertheless it was limited in the clinical on account of complicated operation. In this sample, only 1 case cured by RFCA because of complicate recurrence. Thus, drug becomes the main method of treatment of PSVT.

Prapafenone, belonging to the Na<sup>+</sup> channel blockers, is a broad spectrum of Ic anti-arrhythmic drugs, and can possess the effect of stable the membrane, reduce the maximum climbing speed of action potential of myocardial cells, extend the conduction time of conduction system, reduce the spontaneous excitability of cardiocytes, and block the reentrant excitement, extend the by-pass reentrant time and effective refractory period, healing the PSVT by blocking reentrant<sup>[6,7]</sup>. It is often used as clinical first-line drug on PSVT especially PSVT with pre-excitation syndrome. In this study, the conversion rate of prapofenone(69.77%) was similar with Zhong JR's (73.68%)<sup>[8]</sup>. Some report described propafenone would take good effect on PSVT with no heart failure, but it had another function: inhibite sinoatrial node, retardant atrioventricular conduction, broadening QRS, extend the QTc period, so it might lead to new arrhythmia. For this reason, except ECG monitoring, it is should be carefully used in organic cardiopathy, cardiac insufficiency, neonate and new baby.

Amiodarone, belonging to K<sup>+</sup> channel blockers, is the anti-arrhythmic drugs, and combining fast-sodium channel and slow-calcium channel, so it contains , , anti-arrhythmic drugs characteristics. The main mechanism is to extend the action potential duration (APD) and ERP of atrial muscle, ventricular muscle, atrioventricular node and another accessory atrioventricular pathways, slow down conduction, terminate all kinds of arrhythmia, especially refractoriness tachyarrhythmia and organic

heart disease with cardiac dysfunction<sup>[9,10]</sup>. In this study, 5 cases used amiodarone, 1 case died of DCM, 1 case cured by RFCA, 3 cases were cured, the conversion rate was 75%, exceed report form Cao L (57.1%)<sup>[11]</sup>, but lower than Hang the result from Xue S (88.5%)<sup>[12]</sup>. On the other hand, intravenous injection of amiodarone also had some side effect: hypotension, bradycardia, phlebitis, so we should have ECG monitoring and large vein<sup>[13,14]</sup>.

RFCA has been confirmed as effective method of radical cure the PSVT, also in pediatric PSVT, it has high success rate, safe and effective. From the first report by Van H in 1991, the RFCA was used widely in the word for treatment in the pediatric PSVT. It release radio frequency power through the catheter head, and the radio frequency power transformed into heat between catheter head and endomyocarditis, to a certain temperature, the local myocardial cells come up dehydration, degeneration and necrosis, so the focus of excitation was destroyed, and reentrant cycle was broken, finally the PSVT was cured. The pediatric PSVT had recurrent attacks, it was always recurrence after drug treatment, so the RFCA was used after cardiac electrophysiology checked to that patients. The RFCA main indication was AVNRT and AVRT<sup>[15,16]</sup>.

This research showed, child especially neonate with PSVT, had more no-cardiovascular system symptoms, that would need physical examination carefully by clinician, detection early and treatment early. In the treatment, both propafenone and amiodarone used well in PSVT, the propafenone was still the first-line drug in the clinical especially PSVT with pre-excitation syndrome. Amiodarone terminated all kinds of arrhythmia, especially refractoriness tachyarrhythmia and organic heart disease with cardiac dysfunction. Beyond that, it should must be noticed that any anti-arrhythmic drugs could lead to another arrhythmia, so some measures should be taken to prevent side effect. For complexity and intractable PSVT, RFCA was become the best choice for the pediatric patients.

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## 小儿阵发性室上性心动过速37例临床分析

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**摘要** 目的:对比研究和评价不同方法治疗小儿阵发性室上性心动过速(PSVT)的疗效,提高转复率。方法:回顾性分析2002.04-2011.05我院住院治疗的37例PSVT患儿的临床资料,并分析比较心律平与胺碘酮的药物转复率,构成比采用 $\chi^2$ 检验, $\alpha=0.05$ 。结果:37例患儿中,13例治疗原发病后自动转复,24例患儿给予心律平治疗,其中1例放弃治疗,5例未见效,心律平转复率为69.77%,5例未见效患儿改用胺碘酮治疗,1例死于原发病,1例控制症状后行射频消融术治愈,胺碘酮转复率为75%,二者之间无显著差异性。结论:心律平与胺碘酮均能较好的治疗小儿PSVT,对于反复发作,药物治疗无效的小儿PSVT,射频消融术已成为最佳选择。

**关键词** 阵发性室上性心动过速;临床特点;治疗;心脏复律

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