

Management of Supraventricular Tachycardia in Infancy and Childhood

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Supraventricular tachycardia (SVT) in infancy and early childhood is dangerous and potentially fatal, but if it is diagnosed early and treated appropriately it has an excellent prognosis. Until a few years ago the recommended initial treatment was usually either digoxin or cardioversion. Digoxin, however, was often ineffective and cardioversion required anesthesia or sedation and was not easily repeated if the tachycardia recurred. Many newer forms of treatment have emerged including verapamil, flecainide and adenosine. More recently the dangers of some of these treatments have been recognized, particularly the use of verapamil in neonates(1,2). We report two cases of SVT successfully managed with cardioversion and verapamil, respectively.

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Case Reports

A 16-month-old girl was admitted with history of fever and bluish discoloration of extremities. Physical examination revealed a febrile child with peripheral cyanosis. She had a heart rate of more than 250 beats/min. On investigating during tachycardia the surface 12 lead electrocardiogram tracing showed regular narrow QRS tachycardia, with heart rate varying from 240 to 280/min. Organic heart disease was ruled out on echocardiography. Peripheral smear demonstrated trophozoite form of *P. vivax*. Sinus rhythm was restored in this child using electrical cardioversion of 1 joule/kg but tachycardia recurred within 2 hours, which was successfully terminated with intravenous verapamil in a dose of 0.1 mg/kg over a period of 2 minutes. Subsequent ECG records were normal and child was discharged on oral digoxin after 5 days. Follow up examinations at 1, 3 and 6 months revealed a normal heart rate in sinus rhythm.

A 9-month-old boy was admitted with history of fever and respiratory distress. Clinical examination revealed a sick child with poor peripheral perfusion. Heart rate was more than 200/min. Electrocardiogram tracing showed narrow QRS tachycardia with heart rate of 230/min. Sinus rhythm was restored immediately with electrical cardioversion of 2 joules/kg. The procedure was performed under sedation in PTCU. Echocardiogram done on this child revealed a normal heart. The child was discharged after 7 days on oral digoxin. On subsequent follow up examinations, he was found to be in normal sinus rhythm.

Discussion

The diagnosis of SVT in infant is not always straight forward, and its importance is not always fully appreciated. It may be

difficult, however, to differentiate clinically between a tachycardia of 200-240/minute (which may be sinus tachycardia) and a rate of 250 and above, which is always an arrhythmia. For this reason, when there is any doubt, an electrocardiogram should be obtained so that the heart rate can be accurately measured. Some electrocardiographic monitors are unable to count accurately at rates above 200 or 230/minute and should not be relied upon for an accurate measurement of the heart rate.

In most infants and children who have SVT without associated cardiac diseases, adequate hemodynamic status is maintained for extended periods. The length of time these arrhythmias will be tolerated is a function of (a) the underlying state of the myocardium, (b) the rate of tachycardia, and (c) the duration of abnormal rhythm (3).

The first episode of SVT in infancy should also be treated(4). The ideal treatment for SVT in early infancy (or for that matter at any age) should be safe, rapidly effective in restoring sinus rhythm, easily carried out, free of side effects and should prevent a recurrence of tachycardia or can be easily repeated if tachycardia recurred(3).

Vagal manoeuvres are easy to perform, quick, safe and often successful. Immersion of infants face in cold water, to elicit diving reflex was effective in 90% of patients but SVT recurred in 69% of cases(5). Carotid sinus massage, valsalva manoeuvre and gagging and patient with a tongue depressor are other vagal manoeuvre which may be tried in succession but will most likely not be successful in children under the age of 4 years(6).

Synchronized electrical cardioversion is the emergency treatment of choice for any patient with SVT in an unstable hemody-

namic state or severe congestive heart failure. Cardioversion when carried out correctly is safe and effective. Patient should be "anesthetized" by an agent such as valium or pentothal or ketamine prior to attempted cardioversion. The usual dose for cardioversion is 1-2 joules/kg. Sinus rhythm is restored almost immediately in most of the patients but recurrence of tachycardia is common(7).

Until recently, most of patients were treated with intravenous or intramuscular digoxin. Various studies have shown that digoxin is effective in 50-87% of patients(5). Miscalculation of pediatric doses of digoxin is a common error(7) and there is a wide variation in the recommended doses for infants(8). With availability of better drugs digoxin is no longer preferred in acute management of SVT.

Verapamil is extremely effective in terminating supraventricular tachycardias, particularly those involving the AV node(9). Its advantage over digoxin is that it has a very rapid onset of action (3-5 minutes) and the effects are seen immediately. The usual initial dose of verapamil is 0.075-0.15 mg/kg intravenously with a maximum dose of 5 mg. It can be repeated between 10 and 30 minutes following the initial dose. Although verapamil has been proven to be superior to digitalis in the immediate pharmacologic conversion of SVT, it also has higher incidence of side effects, including AV block, extreme bradycardia, asystole, hypotension and congestive heart failure especially in young infants(10). The adverse cardiovascular effects can generally be overcome by treatment with β -adrenergic agents such as isoproterenol and parenteral administration of calcium. However, the deleterious risk: benefit ratio of verapamil in infants under age 6 months has led to

its use being contraindicated in this age group(10).

Flecainide is a further antiarrhythmic drug which has been proven to be an effective agent in the treatment of SVT caused by a variety of mechanisms. Zeigler *et al.* (11) reported its successful use in 8 of 16 patients with SVT who had failed management with other medications. However, flecainide is negatively inotropic and can be proarrhythmic(12).

Besides the above mentioned drugs, adenosine appears to be the most promising antiarrhythmic agent. It acts by slowing atrioventricular nodal conduction, thus disrupting a re-entry circuit. It has rapid onset of action and is effective within 10 to 20 seconds of being given intravenously in approximately 80% of junctional tachycardias(13). It has a short half life of 10-15 seconds so side effects, which occur in one third of treated patients, are transient and rarely require intervention. Additionally adenosine is not negatively inotropic in this form and so may be given to an infant or child with low cardiac output without fear of hemodynamic worsening. Recurrence of tachycardia in up to 30% of patients is its main disadvantage(13).

Of the many antiarrhythmic agents available all have potential disadvantages. In the acute situation when vagal manoeuvres fail and there is hemodynamic compromise, cardioversion should be tried. If ventricular function is not seriously impaired flecainide or verapamil may be used to terminate SVT. Nonetheless, because of high safety profile of adenosine, it will remain the drug of first choice for terminating SVT.

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Truncus Arteriosus and Depressor Anguli Oris Muscle Deficiency

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Truncus arteriosus is described along with facial dysmorphism because of the defective development of II and IV branchial arches. This indicates embryological insult between the fourth and seventh weeks of gestation. However, truncus with depressor anguli oris muscle deficiency and polysyndactyly have not been reported. We report such a case in a newborn baby.

Case Report

A one-day-old male baby born to a

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nonconsanguinous primigravida mother at 36 weeks of gestation by normal vaginal delivery, was brought to our Neonatal Unit with history of not sucking well. There was no history of any abortion, radiation or drugs in the first trimester of pregnancy. The mother did not suffer from diabetes or any other illness.

The baby weighed 2.2 kg and was tachypneic. There was depressor anguli oris muscle deficiency on the left side (*Fig. 1*) and polydactyly in both the lower limbs. The cardiovascular system examination showed mild cardiomegaly, normal heart sounds and an ejection systolic murmur of Grade III intensity over the left lower sternal border. The liver was palpable 4 cm below the right costal margin in the mid-clavicular line. X-ray chest showed cardiomegaly (CT ratio 62%) and thymic shadow could be appreciated in the X-ray. Serum calcium was normal. The echocardiographic findings were diagnostic of type I truncus, large atrial septal defect and subaortic ventricular septal defect. The baby was treated symptomatically and planned for cardiac surgery at a later date.

Discussion

Persistent truncus arteriosus is an uncommon cardiovascular malformation accounting for 1 to 4% of cardiac deformities found in a number of large autopsy series(1). The defect results from failure of septation of embryonic truncus by the infundibular