Clinical Reports

Transoesophageal pacing for perioperative control of neonatal paroxysmal supraventricular tachycardia

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The perioperative management of a 16-day-old infant with recurrent supraventricular tachycardia (SVT) is discussed. Vagal manoeuvres and medication were not adequate in controlling the SVT. Since the patient was scheduled for extensive surgery in the prone position, it was decided to use transoesophageal pacing as the method of choice for conversion of SVT. Transoesophageal pacing succeeded several times in overriding the SVT and restoring normal heart rate and haemodynamic variables. The advantages and disadvantages of various methods of treating SVT in the newborn are discussed.

La conduite périopératoire d'un enfant âgé de 16 jours avec une tachycardie supraventriculaire récurrente (SVT) est discutée. Les manoeuvres de stimulation vagale et les médicaments étaient incapables de contrôler la SVT. Etant donné que le patient était cédulé pour une chirurgie extensive en position ventrale, il a été décidé d'utiliser un pace maker transoesophagien comme méthode de choix pour convertir la SVT. Le pacing transoesophagien a réussi à plusieurs reprises à supprimer la SVT et restaurer le rythme normal ainsi que les données hémodynamiques. Les avantages et désavantages de plusieurs méthodes de traitement de la SVT chez le nouveau-né sont discutés.

Key words
ANAESTHESIA: cardiac, paediatric;
HEART: pacemakers, artificial, transoesophageal.

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Paroxysmal supraventricular tachycardia is an uncommon, but life-threatening, arrhythmia in the newborn. Treatment of this type of dysrhythmia has traditionally been with vagal manoeuvres, followed by pharmacological therapy or external cardioversion, depending on the degree of cardiac decompensation. Recently, transoesophageal pacing has been added to therapies for conversion of supraventricular tachycardias in the paediatric patient. This case reports the use of transoesophageal pacing as a prospective mode of therapy for a neonate with recurrent supraventricular tachycardia presenting for emergency cervical laminectomy to be performed in the prone position.

Case report

A 16-day-old, 4.2 kg infant with a two-week history of progressive lower extremity flaccidity was scheduled for emergency cervical laminectomy in the prone position. Fetal tachycardia with a heart rate between 230–260 bpm for periods of 2–55 minutes was noted before birth. This tachycardia continued after birth. Episodes of this narrow complex tachycardia often terminated spontaneously, but occasionally required cardioversion. Ice applied to the head or vagal manoeuvres would sometimes cause conversion, but neither propranolol, digitalis, or procainamide prevented recurrence of tachycardia. Echocardiography revealed a dilated right atrium and right ventricular hypertrophy, but no other abnormalities. By the combined use of 12 lead and transoesophageal electrocardiograms the diagnosis was made of supraventricular tachycardia with concealed accessory atrioventricular conduction pathway (orthodromic reciprocating tachycardia). Because of the recurrence of the tachycardia, treatment with oral verapamil (5 $mg \cdot kg^{-1} \cdot day^{-1}$) was started.

At two weeks of age, an MRI scan of the brain and spine suggested a cervicothoracic syrinx. An emergency cervical spine exploration was scheduled. At the time, the

infant was 16 days old and had been without tachycardia for 36 hr.

Because of the patient's age and the manipulations anticipated during the procedure (intubation, head movement, cord compression/traction), it was judged that a vagolytic agent might be necessary during surgery. Atropine IM was given preoperatively to judge the patient's response. Approximately 45 min after 0.1 mg, the patient suddenly developed a tachycardia at a rate of 250 bpm. Blood pressure and perfusion were not significantly altered by the tachycardia, although the child appeared slightly tachypnoeic. Ice and vagal manoeuvres had no effect. The tachycardia was promptly converted by using a Medtronic Model 6902 transoesophageal pacing catheter (two stimuli of 10 mA, 10 msec duration, at a rate of 300 bpm). The pacing catheter was left in place, and the patient was brought to the operating room. Anaesthesia was induced with thiopentone and tracheal intubation facilitated by vecuronium. He was positioned prone for the surgical procedure. Halothane was the primary anaesthetic agent. Throughout the procedure, the heart rate stayed between 90–120 bpm.

Four days later, the patient returned to the operating room for reexploration of the cervical spine. The patient was anaesthetized using a technique identical to that described earlier, except that glycopyrrolate, 0.05 mg, was used preoperatively instead of atropine. The transoesophageal pacing catheter was placed before the induction of anaesthesia. During the three-hour procedure, the patient required pacing five times for recurrence of tachycardia. Each time, the tachycardia resolved immediately with transoesophageal pacing.

TREATMENT OF PAROXYSMAL SUPRAVENTRICULAR TACHYCARDIAS

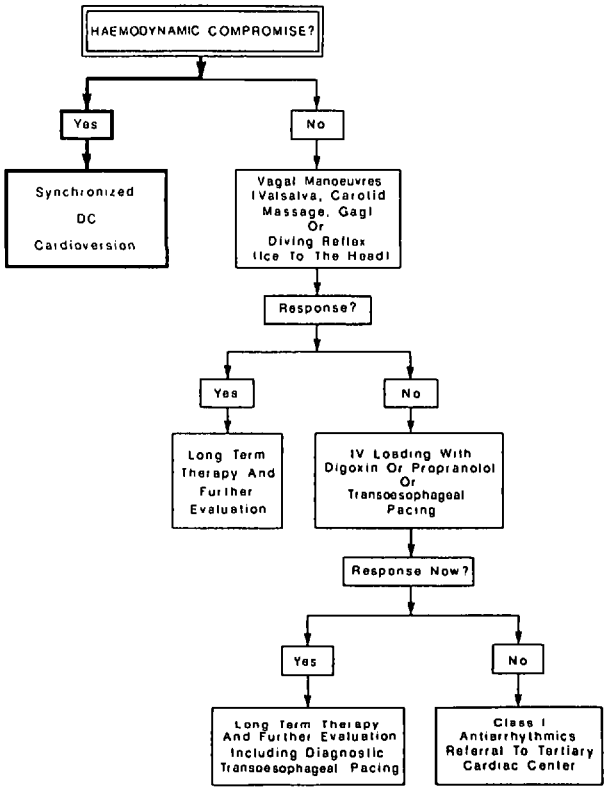

FIGURE Suggested treatment plan for supraventricular tachycardia, including the role of transoesophageal pacing.

Discussion

This case details the first reported elective use of transoesophageal pacing for operative treatment of supraventricular tachycardia in a newborn undergoing non-cardiac surgery. Paroxysmal supraventricular tachycardia is infrequent in neonates. Maintenance of normal heart rate and rhythm is especially critical in the neonate. The neonatal heart is able to compensate for bradycardia or severe tachycardias poorly since cardiac output is largely rate-dependent.[1,2] Intermittent or mild tachycardia may present as fussiness or poor feeding, but severe tachycardia is associated with congestive cardiac failure and is a true medical emergency.

The treatment of paroxysmal supraventricular tachycardia in infants is controversial (Figure). Most clinicians agree that if the patient is haemodynamically stable, an attempt should be made to terminate the tachycardia by manoeuvres that increase vagal tone. This can be done by the use of the Valsalva manoeuvre (pressing on the baby's abdomen), carotid sinus massage, inducing a gag reflex with the use of a suction catheter, or by the use of the diving reflex (placing an ice bag on the patient's face and holding it in place for 15–30 sec). If all these are unsuccessful, pharmacological conversion should be considered. Intravenous digitalis can be effective, but may take 2–6 hr for a response. In older children, intravenous verapamil would be a first-line drug choice for conversion of supraventricular tachycardia. The use of verapamil in infants under one year old, however, is controversial. It has been associated with apnoea, bradycardia, hypotension and cardiac arrest.[2,3]

Transvenous pacing is an alternative to pharmacological treatment of these supraventricular tachydysrhythmias, but is technically difficult in the neonate. Transthoracic cardioversion has long been the method of choice for treatment of these tachycardias if haemodynamic decompensation occurs.[4]

Transoesophageal pacing has recently become an effective modality for both the diagnosis and treatment of supraventricular tachydysrhythmias.[5–8] The technique involves placement of a transoesophageal electrode in a manner that is very similar to nasogastric tube placement.

The proper insertion depth of the pacing catheter in children can be determined from a nomogram with height as the determinant, as described by Benson.[7] The information gained by the transoesophageal electrocardiogram is often helpful in the diagnosis of the precise nature of the supraventricular tachycardia. In addition, transoesophageal conversion of tachycardias (including atrial flutter, orthodromic reciprocating tachycardia, and tachycardias due to reentry within the AV node) has been accomplished in patients of various ages, including neonates.[6] A properly positioned transoesophageal catheter can often result in successful conversion by use of a low current atrial stimulus of 5 to 10 msec duration at a rate above that of the aberrant rhythm. There is generally little discomfort in the awake patient.[7] Complications from this minimally invasive procedure are rare.

During this patient's first operative procedure, there was a potential for bradycardia during anaesthetic and surgical manipulations.[9] Prophylactic preoperative atropine, however, appeared to induce supraventricular tachycardia. There was concern that transthoracic cardioversion would be mechanically difficult to perform with the newborn draped for surgery in the prone position. It was decided to proceed with cardioversion by transoesophageal pacing because of the potential adverse side-effects of intravenous verapamil in the neonate and because of the urgency of the surgical procedure. Since the catheter was in place throughout the surgical procedure, it was available for the treatment of tachycardia or bradycardia. Although the catheter was not used during the initial surgical procedure, it was used several times for termination of supraventricular tachycardia during the patient's second surgical procedure. Glycopyrrolate was used during the second surgical procedure both for secretion control and prevention of bradycardia. Since the transoesophageal pacer could have been used to treat bradycardia as well as tachycardia, it might have been advisable to avoid any vagolytic agent.

Transoesophageal pacing is now considered to be a first-line treatment in paroxysmal supraventricular tachycardias that not respond to vagal or diving manoeuvres.[6] The intraoperative use of the transoesophageal pacer has the added benefit of allowing the anaesthetist to pace the heart atrially or ventricularly in the event of intraoperative bradycardia. Transoesophageal pacing should be considered a reasonable alternative to pharmacological treatment of paroxysmal supraventricular tachycardia occurring in the neonate, especially during the perioperative period.

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