# Usefulness of Routine Transtelephonic Monitoring for Supraventricular Tachycardia in Infants

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**Objective** We hypothesize that routine daily transtelephonic monitoring (TTM) transmissions can accurately detect supraventricular tachycardia (SVT) in asymptomatic infants and/or assuage parental concerns rather than being used solely to diagnose arrhythmias.

**Study design** Single center, retrospective chart review of 60 patients with fetal or infant SVT prescribed TTM for at least 30 days, January 2010-September 2016. Patients were excluded if initial SVT was not documented, was perioperative, was atrial flutter/fibrillation, or chaotic atrial tachycardia. Categorical variables expressed as mean ± SD. Mann-Whitney, Spearman correlation, and Fisher exact tests were used for continuous and categorical variables respectively.

**Results** Sixty patients were included. There were 2688 TTM transmissions received from 55 of 60 patients over 61.1 ± 66.7 days (0.73 ± 0.65 TTM/patient/days). Routine asymptomatic TTM transmissions revealed actionable findings in 5 of 2801 TTM transmissions sent by 5 patients (8.3%). No patient presented in shock or died. Forty-five of 2688 TTM transmissions were sent for parental concerns/symptoms in 16 patients (25.8%) with findings of normal sinus rhythm in 37 of 45 TTM transmissions and SVT in 8 of 45 TTM transmissions. Symptomatic actionable findings were more likely sent by patients discharged on class I or III antiarrhythmics (95% CI = 11.5%-68.3%, $P = .004$) and patients with prolonged initial hospitalizations (95% CI = 6.98%-59.7%, $P = .01$). Flecainide was discontinued in 1 patient after widened QRS was noted on routine TTM.

**Conclusions** TTM accurately diagnose asymptomatic recurrent SVT in neonates and infants before they develop signs of congestive heart failure or shock and is helpful for recurrent SVT management. *(J Pediatr 2017;■■:■■-■■).*

Supraventricular tachycardia (SVT) is the most common sustained arrhythmia in children, commonly presenting before 2 months of age. Incidence ranges from 1 in 25 000 to 1 in 250 children.[1] Infants with SVT may require further medical treatment. Whereas older children and young adults are usually able to express the symptoms of palpitations indicating recurrence of SVT, infants are unable to do so. The infants are usually sent home with further follow-up and possible medical management, but the presence of recurrence is often hard to assess. The interval time period between follow-up visits routinely goes unmonitored. Recurrence of SVT depends on the parental ability to detect a fast rhythm or at times subtle nonspecific clinical changes in their child's appearance. Thus, recurrence of SVT in the infant population may be easily missed or misdiagnosed.

Although infants with SVT may initially be asymptomatic, prolonged episodes can result in congestive cardiac failure and/or cardiovascular shock.[2] Studies have reported mortality rates up to 5% in infants presenting with SVT.[3-5] It is, therefore, important to have prompt diagnosis to facilitate proper care. Thus, home event monitoring may facilitate timely diagnosis and reduce overall morbidity.

Home transtelephonic electrocardiographic monitors use a small recording device containing electrodes that has the capability of recording an electrocardiogram only when activated, manually or automatically. Recordings are then transmitted transtelephonically to their physician according to routine schedule or when parents feel that their child is symptomatic.

Although prior studies evaluated the efficacy of transtelephonic electrocardiographic monitors as well as Holter monitors in the pediatric population,[6,7] these studies investigated monitors that were used to diagnosis arrhythmias in older patients with symptoms suspicious for arrhythmias rather than being used for routine scheduled monitoring for SVT recurrence in infants who are unable to express symptoms.

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| ED | Emergency department |
| NSR | Normal sinus rhythm |
| SVT | Supraventricular tachycardia |
| TTM | Transtelephonic monitoring |

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## Methods

The arrhythmia database at the Steven and Alexandra Cohen Children's Medical Center of New York from January 2010-September 2016 was reviewed. Eighty-one patients with fetal or infantile SVT between the ages of 1 day and 1 year of age who were prescribed with home transtelephonic electrocardiographic monitors for at least 30 days were identified. Postevent monitors are routinely prescribed for all infants diagnosed with SVT upon discharge from their initial hospitalization with SVT. Parents were instructed to place the monitor on the child's chest, record the rhythm, and then to send a transmission in the morning as well as in the evening on a routine daily basis for at least 30 days. They were also educated about the clinical signs of SVT and to send a transmission when they had concern that their child was having SVT. All event monitor transmissions were immediately reviewed by a third party telemetry company. If SVT was seen, families were asked to resubmit a transtelephonic monitoring (TTM) transmission to assess if the child was still experiencing SVT. Guidelines were given to the company as to when to contact the clinical cardiology team. Concerning TTM transmissions were sent to and reviewed by the cardiology clinical team. Actionable findings were defined for this retrospective study as those changes in management made by the pediatric cardiology team caring for the patient in response to the findings on the transmission. Patients were excluded if initial SVT was not clearly documented, the initial SVT occurred in the perioperative period, or if the patient had atrial fibrillation, atrial flutter, or chaotic atrial tachycardia.

Sixty patients met study inclusion criteria. Information pertaining to patients' demographic data, cardiac diagnosis, indication for home transtelephonic electrocardiographic monitors, and medical management were obtained from patients' medical records. This included clinical data from outpatient visits and/or emergency department (ED) visits including, but not limited to provider notes, electrocardiograms, and echocardiograms. All home cardiac event monitor transmissions were re-assessed and divided into 2 groups, asymptomatic and symptomatic transmissions. A diagnosis of recurrent SVT was made if there was evidence of SVT on sent transmissions. SVT was defined as an abnormal rapid rhythm, usually narrow complex, involving atrial tissue or the atrioventricular node.[8] A prolonged hospitalization was defined as one longer than the median length of stay for patients included in the study. This study was approved by the institutional review board with waiver of informed consent.

Analysis was performed using descriptive statistics with means and SDs. Comparisons of categorical variables were made using the Fisher exact test and those of continuous variables were made using Mann-Whitney test and Spearman correlation statistics, where appropriate.

## Results

Data was reviewed from 60 patients with fetal and/or infant SVT subsequently discharged with transtelephonic monitors after initial hospitalization. Age at initial diagnosis of SVT ranged from day of life 1 to day of life 175 with a mean age of 20 ± 32 days. Of these patients, 41 or 68% were male. SVT diagnoses included orthodromic reciprocating tachycardia in 47 (78.3%), atrial tachycardia in 11 (18.3%), congenital junctional ectopic tachycardia in 1 (1.7%), and permanent junctional reciprocating tachycardia in 1 (1.7%).

The average length of stay at initial diagnosis of SVT was 11.1 ± 14.7 days. The median length of stay was 6 days (range 2-90 days). Twenty-seven patients had prolonged initial hospital stay of more than the median length of stay for all patients. Fifteen patients were discharged home on at least 1 class I or class III antiarrhythmic medication.

A total of 2688 transtelephonic monitor transmissions were received from 55 patients. Five patients who were prescribed transtelephonic monitors for 30 days did not send any transmissions but were included as part of an intention-to-treat analysis. Patients sent 44.8 ± 51.7 transmissions during an average monitoring period 61.1 ± 66.7 days. Thus, each patient sent 0.73 ± 0.65 transmissions each day. Recurrent SVT was detected by TTM in 10 patients (16.7%) overall regardless of symptoms.

A total of 2643 transmissions were sent on a routine basis in the absence of parental concerns corresponding to 44 ± 50.8 transmissions per patient or 0.72 transmissions per day for each patient.

Number of routine transmissions was not associated with length of stay and medical regimen. Patients with prolonged initial hospitalizations sent an average of 0.74 ± 0.67 transmissions per day vs 0.7 ± 0.63 transmissions per day from patients with a normal initial hospital duration (95% CI 0.21-0.29, $P < .82$). In addition, those taking a class I and/or class III antiarrhythmics sent an average of 0.81 ± 0.72 transmission per day vs 0.7 ± 0.62 transmissions per day from those not taking class I or class III antiarrhythmics, (95% CI 0.51-1.25, $P < .54$).

Twenty-four of 60 patients initially diagnosed with SVT were out of the perinatal period had no other comorbidities extending their hospital length. Thirty-six patients were diagnosed in the perinatal period or fetal life. Of these, the average gestation age was 37.5 weeks ranging from 24 to 41 weeks. Seven of the 36 were born prematurely defined as a gestational age <36 weeks. Of the 7 premature children, 2 had prolonged hospital stay directly related to their SVT. The other 5 had prolonged hospital stay likely secondary to other comorbidities as assumed by their premature age. There was no statistical difference in the average number of TTM transmissions sent by these 5 patients (38.4 ± 37.9) compared with the other 55 patients (45.4 ± 52.7) $P = .77$.

Routine asymptomatic transmissions revealed actionable findings on 5 of 2643 transmissions, from 5 asymptomatic patients (8.3%) (4 patients had orthodromic reciprocating tachycardia and 1 patient had ectopic atrial tachycardia). As outlined in **Figure 1**, actions taken included evaluation in the ED, admission to the pediatric intensive care unit, medication dose adjustment, initiation of a new medication, and ablation. Age at SVT recurrence in the asymptomatic group ranged from 9



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