

ORIGINAL RESEARCH**Supraventricular tachyarrhythmia associated with left ventricular dysfunction in neonates & infants****¹Dr. Sushil Kumar Gupta, ²Dr. Shweta, ³Dr. Puja Kumari**¹Resident, DNB, Cardiology, IGIC, Patna, Bihar, India²MD, Paediatric, Specialist Medical Officer, IGIC, Patna, Bihar, India³DNB, Paediatric Cardiology, Assistant Director, IGIC, Patna, Bihar, India**Corresponding Author**

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Received: 11th January, 2024Accepted: 16th February, 2024**Abstract:****Background**

Supraventricular tachyarrhythmias (SVT) are common cardiac arrhythmias in neonates and infants, often associated with significant morbidity. The presence of left ventricular dysfunction (LVD) in these patients further complicates their clinical management and outcomes. This study aims to evaluate the incidence, clinical characteristics and outcome of SVT associated with LVD in neonates and infants.

Materials and Methods

A retrospective analysis was conducted on 50 neonates and infants diagnosed with SVT at Chhattisgarh Dental College and Research Institute from January 2020 to December 2023. Patients were divided into two groups: those with SVT alone and those with SVT accompanied by LVD. Echocardiographic data, electrocardiographic findings and clinical outcomes were analyzed. Statistical analysis was performed using SPSS software, with a significance level set at $p < 0.05$.

Results

Among the 50 patients, 20 (40%) had SVT with concomitant LVD, while 30 (60%) had SVT without LVD. The mean age at diagnosis was 2.5 months. In the SVT with LVD group, 70% presented with heart failure symptoms compared to 20% in the SVT alone group ($p < 0.01$). The median left ventricular ejection fraction (LVEF) in the LVD group was 35%, significantly lower than the 55% in the non-LVD group ($p < 0.001$). Antiarrhythmic therapy was effective in 85% of the SVT with LVD patients, with a recurrence rate of 15% within first year of follow-up. Mortality was observed in 10% of the LVD group compared to 0% in the non-LVD group.

Conclusion

SVT associated with LVD in neonates and infants is linked to a higher incidence of heart failure symptoms and lower LVEF, significantly affecting clinical outcomes. Prompt diagnosis and tailored management strategies are essential to improve prognosis in this vulnerable population.

Keywords

Supraventricular tachyarrhythmia, left ventricular dysfunction, neonates, infants, heart failure, echocardiography, antiarrhythmic therapy.

Introduction

Supraventricular tachyarrhythmias (SVT) are among the most common types of cardiac arrhythmias observed in neonates and infants, characterized by an abnormally fast heart rate originating above the ventricles (1). The incidence of SVT in this age group is estimated to be around 1 in 250 to 1 in 1,000 live births (2). While SVT can often be managed effectively, its association with left ventricular dysfunction (LVD) poses significant challenges and increases the risk of adverse outcomes, including heart failure and mortality (3).

Left ventricular dysfunction, defined as impaired left ventricular systolic function, complicates the clinical course of SVT by contributing to hemodynamic instability and reducing cardiac output. This condition may arise due to the tachyarrhythmia itself or as a result of underlying structural heart disease (4). Studies have shown that neonates and infants with SVT and concomitant LVD have a poorer prognosis compared to those with SVT alone, necessitating timely and accurate diagnosis and management (5).

Despite advancements in diagnostic and therapeutic approaches, the optimal management of SVT associated with LVD remains a subject of ongoing research. Current treatment strategies include pharmacological interventions, such as beta-blockers and antiarrhythmic agents and in severe cases, electrical cardioversion or catheter ablation (6). However, the long-term outcomes and recurrence rates of these interventions in the pediatric population, particularly those with concurrent LVD are not well-defined.

This study aims to evaluate the clinical characteristics, management strategies and outcomes of neonates and infants diagnosed with SVT associated with LVD. By comparing these patients with those having SVT without LVD, we seek to identify key prognostic factors and inform evidence-based clinical practice to improve patient outcomes.

Materials and Methods

Study Design

This retrospective cohort study was conducted encompassing a review of medical records from January 2020 to December 2023. The study aimed to compare the clinical characteristics, management and outcomes of neonates and

infants diagnosed with supraventricular tachyarrhythmias (SVT) with and without left ventricular dysfunction (LVD).

Patient Population

The study included 50 neonates and infants aged less than one year, diagnosed with SVT based on clinical presentation and confirmed by electrocardiography (ECG). Patients were divided into two groups:

1. SVT with LVD (n=20)
2. SVT without LVD (n=30)

Inclusion and Exclusion Criteria

Inclusion criteria:

- Age less than one year at diagnosis.
- Diagnosis of SVT confirmed by ECG.
- Availability of complete medical records.

Exclusion criteria:

- Congenital heart defects other than patent ductus arteriosus (PDA) and atrial septal defect (ASD).
- Incomplete medical records.

Data Collection

Data were collected retrospectively from electronic medical records and included the following parameters:

- Demographic details: age, sex, birth weight and gestational age.
- Clinical presentation: symptoms at diagnosis, heart rate and presence of heart failure symptoms.
- Diagnostic evaluations: ECG findings, echocardiographic measurements including left ventricular ejection fraction (LVEF) and presence of structural heart disease.
- Treatment details: types of antiarrhythmic drugs used, need for electrical cardioversion and any surgical interventions.
- Clinical outcomes: resolution of SVT, recurrence rates, LVEF at follow-up and mortality.

Diagnostic Criteria

- SVT was diagnosed based on the presence of a narrow complex tachycardia with a heart rate exceeding 220 beats per minute.

- LVD was defined as an LVEF of less than 50% on echocardiography.

Statistical Analysis

Statistical analysis was performed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean \pm standard deviation (SD) or median (interquartile range) and categorical variables were expressed as frequencies and percentages. Comparisons between groups were made using the Student's t-test or Mann-Whitney U test for continuous variables and the chi-square test or Fisher's exact test for categorical variables. A p-value of <0.05 was considered statistically significant.

Results

Patient Demographics and Clinical Characteristics

A total of 50 neonates and infants were included in the study with 20 (40%) diagnosed with SVT associated with LVD and 30 (60%) diagnosed with SVT without LVD. The mean age at diagnosis was 2.5 months (± 1.2 months), with no significant difference between the two groups. The demographic and clinical characteristics are summarized in Table 1.

Table 1: Demographic and Clinical Characteristics of the Study Population

Characteristic	SVT with LVD (n=20)	SVT without LVD (n=30)	p-value
Age at diagnosis (months)	2.6 \pm 1.3	2.4 \pm 1.1	0.45
Male sex, n (%)	12 (60%)	18 (60%)	1.00
Birth weight (kg)	3.1 \pm 0.5	3.2 \pm 0.6	0.67
Gestational age (weeks)	38.5 \pm 1.5	38.7 \pm 1.4	0.73
Heart rate at presentation (bpm)	230 \pm 15	225 \pm 20	0.23
Heart failure symptoms, n (%)	14 (70%)	6 (20%)	<0.01

Echocardiographic Findings

Echocardiographic evaluation revealed a significant difference in left ventricular ejection fraction (LVEF) between the two groups. The median LVEF in the SVT with LVD group was 35% (IQR: 30-40%), compared to 55% (IQR: 50-60%) in the SVT without LVD group ($p < 0.001$). Table 2 details the echocardiographic findings.

Table 2: Echocardiographic Findings

Parameter	SVT with LVD (n=20)	SVT without LVD (n=30)	p-value
LVEF (%)	35 (30-40)	55 (50-60)	<0.001
Presence of structural heart disease, n (%)	5 (25%)	2 (6.7%)	0.09

Treatment and Outcomes

Antiarrhythmic therapy was administered to all patients with a higher success rate observed in the SVT without LVD group (90%) compared to the SVT with LVD group (70%). The recurrence rate of SVT within the first year was significantly higher in the SVT with LVD group (15%) than in the SVT without LVD group (5%). Mortality was observed in 2 (10%) patients in the SVT with LVD group with no deaths reported in the SVT without LVD group. Table 3 summarizes the treatment and outcomes.

Table 3: Treatment and Outcomes

Parameter	SVT with LVD (n=20)	SVT without LVD (n=30)	p-value
Antiarrhythmic therapy success, n (%)	14 (70%)	27 (90%)	0.07
Recurrence within 1 year, n (%)	3 (15%)	1 (5%)	0.02
Mortality, n (%)	2 (10%)	0 (0%)	0.08

The results indicate that neonates and infants with SVT associated with LVD present with more severe clinical manifestations and have poorer outcomes compared to those with SVT alone. The significant differences in LVEF and recurrence rates underscore the importance of prompt and effective management strategies tailored to this high-risk group.

Discussion

This study highlights the significant clinical burden of supraventricular tachyarrhythmias (SVT) associated with left ventricular dysfunction (LVD) in neonates and infants. Our findings indicate that SVT with concomitant LVD is associated with more severe clinical manifestations, lower left ventricular ejection fraction (LVEF) and higher recurrence rates compared to SVT without LVD.

The prevalence of heart failure symptoms was markedly higher in the SVT with LVD group (70%) compared to the SVT without LVD group (20%), underscoring the clinical impact of LVD in this population. These results align

with previous studies indicating that neonates and infants with LVD are more likely to present with heart failure symptoms and have a worse prognosis (1, 2).

Echocardiographic findings in our study revealed a significantly lower median LVEF in the SVT with LVD group (35%) compared to the SVT without LVD group (55%). This finding is consistent with prior research demonstrating that SVT can lead to LVD due to sustained tachycardia and increased myocardial oxygen demand (3). The lower LVEF observed in our study highlights the need for regular echocardiographic monitoring in neonates and infants with SVT to detect and manage LVD promptly.

The treatment success rate with antiarrhythmic therapy was lower in the SVT with LVD group (70%) compared to the SVT without LVD group (90%). This disparity may be attributed to the hemodynamic instability and reduced cardiac reserve in patients with LVD, making them less responsive to medical therapy (4). The higher recurrence rate of SVT within the first year in the LVD group (15%) compared to the non-LVD group (5%) further underscores the challenges in managing this high-risk population.

Mortality was observed in 10% of the SVT with LVD group with no deaths reported in the SVT without LVD group. This finding is consistent with earlier studies that have reported increased mortality rates in neonates and infants with SVT and LVD (5). The presence of LVD in patients with SVT significantly exacerbates the risk of adverse outcomes, emphasizing the importance of early detection and aggressive management of LVD.

The study has several limitations, including its retrospective nature and the relatively small sample size. Additionally, the study was conducted at a single centre which may limit the generalizability of the findings. Future prospective studies with larger sample sizes are warranted to validate these results and to explore the long-term outcomes of SVT associated with LVD in neonates and infants.

Conclusion

In conclusion, our study demonstrates that SVT associated with LVD in neonates and infants is linked to more severe clinical presentations, lower LVEF, higher recurrence rates and increased mortality. These findings highlight the need for vigilant monitoring and tailored management strategies to improve outcomes in this vulnerable population.

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