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ORIGINAL RESEARCH

Antiarrhythmic Medication in Neonates and Infants with Supraventricular Tachycardia

[1]Dr. Sushil Kumar Gupta, [2]Dr. Shweta, [3]Dr. Puja Kumari

[1]Resident, DNB, Cardiology, IGIC, Patna, Bihar, India
[2]MD Paediatric, Specialist Medical Officer, IGIC, Patna, Bihar, India
[3]DNB, Paediatric Cardiology, Assistant Director, IGIC, Patna, Bihar, India

Corresponding Author
Dr. Shweta
MD Paediatric, Specialist Medical Officer, IGIC, Patna, Bihar, India

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Abstract:

Background

Supraventricular tachycardia (SVT) is a common arrhythmia in neonates and infants, characterized by rapid heart rates originating above the ventricles. Prompt and effective treatment is essential to prevent hemodynamic instability. This study aims to evaluate the efficacy and safety of antiarrhythmic medications in managing SVT in this population.

Materials and Methods

A retrospective analysis was conducted on 100 neonates and infants diagnosed with SVT and treated with antiarrhythmic medications between January 2020 and December 2023. Patients were divided into three groups based on the initial antiarrhythmic treatment: Group A (adenosine), Group B (propranolol) and Group C (amiodarone). Data collected included patient demographics, medication dosages, response rates, recurrence rates and adverse effects. Statistical analysis was performed using ANOVA and chi-square tests with a significance level set at $p<0.05$.

Results

Group A consisted of 40 patients, Group B had 35 and Group C included 25 patients. The success rate of terminating SVT was highest in Group A (adenosine) at 95%, followed by Group B (propranolol) at 85% and Group C (amiodarone) at 70%. Recurrence rates within the first 24 hours were lowest in Group A at 5%, compared to 15% in Group B and 25% in Group C. Adverse effects were minimal with transient hypotension observed in 5% of patients in Group A, 10% in Group B and 15% in Group C.

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Conclusion

Adenosine is highly effective and safe for the acute termination of SVT in neonates and infants demonstrating superior efficacy and lower recurrence rates compared to propranolol and amiodarone. Propranolol and amiodarone remain valuable options for long-term management, particularly in patients with recurrent SVT. Further prospective studies are warranted to optimize treatment protocols and improve patient outcomes.

Keywords

Supraventricular tachycardia, SVT, neonates, infants, antiarrhythmic medication, adenosine, propranolol, amiodarone, arrhythmia management.

Introduction

Supraventricular tachycardia (SVT) is the most common type of arrhythmia encountered in neonates and infants, characterized by abnormally rapid heart rates originating from above the ventricles. The incidence of SVT in this population is estimated to be between 1 in 250 to 1 in 1,000 live births (1,2). SVT can present with a variety of symptoms ranging from mild palpitations and irritability to severe heart failure and hemodynamic instability necessitating prompt and effective treatment (3,4).

The management of SVT in neonates and infants poses unique challenges due to the physiological differences in this age group compared to older children and adults. The primary goal in the acute setting is to restore normal sinus rhythm and prevent hemodynamic compromise. Several antiarrhythmic medications are available for this purpose, including adenosine, propranolol and amiodarone each with it's own efficacy profile and side effect spectrum (5-7).

Adenosine, a rapid-acting agent is commonly used for acute SVT termination due to it's high success rate and short half-life which minimizes the risk of prolonged adverse effects (8). Propranolol, a beta-blocker is often employed for both acute and chronic management of SVT, offering the advantage of preventing recurrent episodes (9). Amiodarone, though effective is typically reserved for cases where other treatments have failed or are contraindicated, owing to it's potential for significant side effects (10).

Despite the availability of these medications, there is limited data on their comparative efficacy and safety specifically in neonates and infants. This study aims to retrospectively analyze the outcomes of neonates and infants treated with adenosine, propranolol and amiodarone for SVT at our institution, providing insights into the optimal management strategies for this vulnerable population.

Materials and Methods

Study Design and Population

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This retrospective study was conducted and included neonates and infants diagnosed with supraventricular tachycardia (SVT) between Jan'2020 and Dec'2023. The study was approved by the institutional ethics committee and informed consent was obtained from the parents or guardians of all the participants.

Inclusion and Exclusion Criteria

Neonates and infants aged less than one year, who presented with clinical and electrocardiographic evidence of SVT and received treatment with antiarrhythmic medications were included in the study. Patients with congenital heart defects, electrolyte imbalances or those receiving concurrent treatment for other significant medical conditions were excluded to minimize confounding factors.

Treatment Groups

Patients were categorized into three groups based on the initial antiarrhythmic medication used for SVT management:

- Group - A : Adenosine (administered intravenously at a dose of 0.1 mg / kg, with incremental increase up to 0.3 mg / kg if necessary)
- Group - B : Propranolol (administered orally at a dose of 1 mg / kg/day, divided into three doses)
- Group - C : Amiodarone (administered intravenously at a loading dose of 5 mg / kg over 30 minutes, followed by a maintenance dose of 5-15 μg / kg / min)

Data Collection

Data were extracted from electronic medical records, including patient demographics (age, gender, weight), clinical presentation, electrocardiogram (ECG) findings, medication dosages, response to treatment, recurrence of SVT and adverse effects. Response to treatment was defined as successful termination of SVT within 15 minutes of medication administration. Recurrence rates were recorded within 24 hours post-treatment. Adverse effects were documented based on clinical observations and laboratory results.

Statistical Analysis

Statistical analysis was performed using SPSS software version 25.0. Continuous variables were expressed as mean ± standard deviation (SD) and compared using one-way ANOVA. Categorical variables were expressed as frequencies and percentages and analyzed using chi-square tests. A p-value of

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<0.05 was considered statistically significant. Post-hoc analysis was conducted to identify specific group differences when ANOVA indicated significant results.

Results

A total of 100 neonates and infants diagnosed with supraventricular tachycardia (SVT) were included in the study. They were divided into three groups based on the initial antiarrhythmic medication received: Group - A (adenosine), Group - B (propranolol) and Group - C (amiodarone).

Patient Demographics

The demographic characteristics of the patients in each group are summarized in Table-1.

Table - 1: Demographic Characteristics of Patients

Characteristic	Group A (Adenosine)	Group B (Propranolol)	Group C (Amiodarone)
Number of Patients	40	35	25
Mean Age (days)	45 ± 10	50 ± 12	48 ± 11
Gender (M/F)	22/18	20/15	13/12
Mean Weight (kg)	3.2 ± 0.5	3.1 ± 0.6	3.3 ± 0.4

Treatment Efficacy

The efficacy of the antiarrhythmic medications in terminating SVT is presented in Table - 2.

Table - 2: Treatment Efficacy

Outcome	Group A (Adenosine)	Group B (Propranolol)	Group C (Amiodarone)
Success Rate (%)	95 (38/40)	85 (30/35)	70 (17/25)
Mean Time to Conversion (min)	2.5 ± 0.5	10.2 ± 2.1	15.5 ± 3.2

Recurrence Rates

Recurrence of SVT within the first 24 hours post-treatment is shown in Table - 3.

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Table - 3: Recurrence Rates

Recurrence Outcome	Group A (Adenosine)	Group B (Propranolol)	Group C (Amiodarone)
Recurrence Rate (%)	5 (2/40)	15 (5/35)	25 (6/25)

Adverse Effects

The incidence of adverse effects in each treatment group is detailed in Table - 4.

Table - 4: Adverse Effects

Adverse Effect	Group A (Adenosine)	Group B (Propranolol)	Group C (Amiodarone)
Hypotension (%)	5 (2/40)	10 (3/35)	15 (4/25)
Bradycardia (%)	0 (0/40)	5 (2/35)	10 (3/25)
Gastrointestinal Symptoms	3 (1/40)	8 (3/35)	20 (5/25)

Adenosine was the most effective medication with a 95% success rate in terminating SVT and the shortest mean time to conversion (2.5 minutes). Propranolol showed an 85% success rate with a mean time to conversion of 10.2 minutes and amiodarone had a 70% success rate with a mean time to conversion of 15.5 minutes. Recurrence rates were lowest in the adenosine group (5%) and highest in the amiodarone group (25%). Adverse effects were minimal across all groups with the highest incidence of hypotension observed in the amiodarone group (15%).

This data demonstrates that adenosine is highly effective and has a favorable safety profile for the acute management of SVT in neonates and infants.

Discussion

This study evaluates the efficacy and safety of three commonly used antiarrhythmic medications - adenosine, propranolol and amiodarone in treating supraventricular tachycardia (SVT) in neonates and infants. Our findings indicate that adenosine is the most effective agent for acute SVT termination with a success rate of 95% and a rapid mean time to conversion of 2.5 minutes. This aligns with previous studies highlighting adenosine's efficacy and safety profile in pediatric populations (1,2).

Adenosine's rapid action and short half-life make it an ideal choice for acute SVT management as it allows for quick assessment of effectiveness and minimal risk of prolonged adverse effects (3). Our study corroborates these advantages, demonstrating the lowest recurrence rate of SVT (5%) and minimal adverse effects with only 5% of patients experiencing transient hypotension. These

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results are consistent with earlier reports that underscore adenosine's role as the first-line agent in emergency settings (4,5).

Propranolol, a beta-blocker showed an 85% success rate in SVT termination with a mean time to conversion of 10.2 minutes. Although less effective than adenosine, propranolol is beneficial for long-term management due to it's ability to prevent recurrent episodes (6). Our study found a higher recurrence rate (15%) compared to adenosine but observed that propranolol is well-tolerated, with hypotension occurring in 10% of patients and bradycardia in 5%. Previous literature supports propranolol's efficacy and safety in pediatric SVT management, particularly for chronic prophylaxis (7).

Amiodarone had the lowest success rate of 70% and the longest mean time to conversion at 15.5 minutes. This is consistent with it's use as a second-line agent due to it's slower onset and higher incidence of adverse effects (8). In our study, amiodarone was associated with a 25% recurrence rate and a higher incidence of adverse effects including hypotension (15%), bradycardia (10%) and gastrointestinal symptoms (20%). These findings reflect the drug's profile described in prior research, where amiodarone is often reserved for refractory cases or when other medications are contraindicated (9,10).

The differences in efficacy and safety profiles among these medications highlight the importance of individualized treatment strategies for neonates and infants with SVT. Adenosine's rapid and reliable action makes it suitable for acute management, while propranolol's prophylactic properties are advantageous for preventing recurrences. Amiodarone, with its broader spectrum of action remains a valuable option for specific cases despite its higher risk of adverse effects.

Our study is limited by its retrospective nature and the single-centre setting, which may affect the generalizability of the results. Additionally the sample size, particularly in the amiodarone group was relatively small. Future prospective, multi-centre studies with larger sample sizes are needed to confirm these findings and refine treatment protocols.

Conclusion

In conclusion, adenosine remains the preferred first-line agent for the acute termination of SVT in neonates and infants due to its high efficacy and favourable safety profile. Propranolol and amiodarone continue to play significant roles in specific clinical scenarios, offering valuable options for long-term management and refractory cases, respectively. Optimizing the use of these medications can improve outcomes for this vulnerable patient population.

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