ONLINE ISSN :3007-309X
PRINT ISSN :3007-3081

Journal of Medical & Health Sciences Review

EVALUATION OF THE DIAGNOSTIC AND THERAPEUTIC ROLE OF ADENOSINE IN DIFFERENTIATING AND MANAGING ATRIOVENTRICULAR NODAL RE-ENTRANT TACHYCARDIA, ATRIOVENTRICULAR RECIPROCATING TACHYCARDIA, AND ATRIAL FLUTTER

Muhammad Waseem Rafiq[1], Dr. Chanda Naseem[2], Sobia Hassan[3]

[1]MS Cardiology Student, Superior University, Lahore, Email: muhammadwaseemrafiq01@gmail.com
[2]Assistant Professor, Faculty of Allied Health Sciences, Superior University, Lahore
[3]Assistant Professor, Sharif College of Nursing, Lahore.

ARTICLE INFO

Keywords: supraventricular tachycardia; Atrioventricular nodal re-entrant tachycardia; Atrioventricular reciprocating tachycardia; Atrial flutter; Electrocardiogram

Corresponding Author:
Muhammad Waseem Rafiq,
MS Cardiology Student,
Superior University, Lahore,

Email:
muhammadwaseemrafiq01@gmail.com

ABSTRACT

Background: Diagnosing and treating supraventricular tachyarrhythmias such as atrial flutter, atrioventricular nodal re-entrant tachycardia (AVNRT), and atrioventricular reciprocating tachycardia (AVRT) is difficult. Short-acting antiarrhythmic drugs like adenosine are frequently used to stop re-entrant tachycardias and identify the underlying causes of arrhythmias.

Objective: This study evaluates adenosine's therapeutic effectiveness in stopping atrial flutter, AVRT, and AVNRT, and it assesses its ability to distinguish between them.

Methodology: In this single-arm interventional trial, individuals with persistent supraventricular tachyarrhythmias were enrolled in a tertiary care hospital. Intravenous adenosine was given in increments until the arrhythmia stopped or the diagnosis was clear. Clinical and electrophysiological reactions to adenosine were documented to distinguish between AVNRT, AVRT, and atrial flutter.

Results: Palpitations were the most prevalent symptom (94%), followed by dizziness (62%), chest pain (58%), and fatigue (50%). The mean heart rate was 154.7 bpm, with systolic and diastolic blood pressures averaging 124.24 mmHg and 79.5 mmHg, respectively. Oxygen saturation remained stable at 97.78%. Adenosine was administered at 6 mg (56%), 12 mg (38%), and 18 mg (6%), with AVNRT being the most common diagnosis (54%), followed by AVRT (30%) and atrial flutter (12%). Adenosine demonstrated high diagnostic accuracy (AVNRT: 92.59%, AVRT: 93.33%, atrial flutter: 83.33%) and therapeutic success (AVNRT: 85.18%, AVRT: 86.67%). Conversion to sinus rhythm was fastest in AVNRT (15.44 ± 4.98 sec) compared to AVRT (18.57 ± 6.50 sec). Common side effects included

	flushing (42%), chest pain (26%), and dizziness (22%). Post-treatment, 72% required no further intervention, while 20% needed beta-blockers. Adenosine was 89.75% accurate for diagnosis and 68.39% effective for treatment. **Conclusion:** Adenosine is highly effective in diagnosing and terminating SVT, particularly AVNRT and AVRT, with a favorable safety profile. While most patients responded to initial doses, individualized management remains crucial due to variable treatment responses and side effects.

INTRODUCTION:

Adenosine, a purine nucleoside, is a critical agent in the diagnosis and management of supraventricular tachycardias (SVTs) due to its unique ability to transiently inhibit atrioventricular (AV) nodal conduction [1,2]. This property makes it particularly useful in distinguishing between common SVT subtypes, including atrioventricular nodal re-entrant tachycardia (AVNRT), atrioventricular reciprocating tachycardia (AVRT), and atrial flutter. While AVNRT and AVRT are AV node-dependent arrhythmias that adenosine can effectively terminate by interrupting re-entrant circuits, atrial flutter—an atrial-based arrhythmia—typically persists but demonstrates characteristic ECG changes during AV nodal blockade, aiding in diagnosis [3,2].

Adenosine's rapid onset and extremely short half-life (less than 10 seconds) allow for precise assessment of cardiac electrical activity with minimal prolonged hemodynamic effects [4,5]. Its favorable safety profile and efficacy have established adenosine as a first-line treatment for acute SVT management, despite potential transient side effects such as flushing, chest discomfort, and bradycardia [6]. AVNRT, the most prevalent form of SVT, involves a re-entrant circuit within the AV node and is reliably terminated by adenosine, confirming its AV node dependence [7,8,9]. Similarly, AVRT, which involves an accessory pathway alongside the AV node, can be interrupted by adenosine, though conduction through the extra nodal pathway may persist, offering additional diagnostic insights [5]. In contrast, atrial flutter arises from a macroreentrant atrial circuit, and while adenosine does not terminate it, the resulting AV block unmasks flutter waves on ECG, facilitating accurate diagnosis [10].

Despite its diagnostic and therapeutic benefits, adenosine has limitations. It is ineffective in arrhythmias independent of the AV node, such as atrial fibrillation or ventricular tachycardia, and must be used cautiously in patients with asthma or severe coronary artery disease due to risks of bronchospasm or transient ischemia [11]. This review evaluates adenosine's role in differentiating and managing AVNRT, AVRT, and atrial flutter, highlighting its clinical utility and limitations.

Objective: This study evaluates adenosine's therapeutic effectiveness in stopping atrial flutter, AVRT, and AVNRT, and the ability of adenosine to distinguish between them was assessed.

Methodology: A single-arm interventional trial was conducted at the Cardiac Unit of a Tertiary Care Hospital in Lahore, Pakistan, from February 2025 to May 2025. Purposive sampling was used.

Sample size: The sample size was determined to be 50, with a 1.96 sample standard deviation and a 95% confidence interval.

Formula: $\mathbf{n = (k-1)\ (Z_{1-\beta}+Z_{1-\alpha})^2/f^2}$

Inclusion Criteria:

- Male and female
- Adults aged 18years and older.
- Patients with clinical or electrocardiographic evidence of SVTs (AVNRT, AVRT, or atrial flutter).
- Stable hemodynamic status during the arrhythmia episode.

Exclusion Criteria:

- Patients with contraindications to adenosine (e.g., severe asthma, advanced AV block without a pacemaker).
- History of hypersensitivity to adenosine.
- Pregnant or lactating women.
- Unstable hemodynamic conditions requiring immediate cardioversion.
- Presence of chronic arrhythmias such as atrial fibrillation

Study parameters: The study utilized a structured questionnaire consisting of 3 sections: the 1st section gathered demographic information such as gender, education, age, and symptoms (e.g., palpitations, dizziness, chest pain, syncope, fatigue); the 2nd section assessed Diagnostic Parameters includes, Vital signs monitoring (heart rate and blood pressure, and oxygen saturation), arrhythmia differentiation ((AVNRT, AVRT, or atrial flutter). For 3rd section consists of Therapeutic Parameters: Adenosine dose and Time to arrhythmia termination

Ethical Approval: The ethical approval was obtained from the Institutional Review Board (IRB) of Superior University before commencing the study. Maintained participants' confidentiality by ensuring all data was anonymized and securely stored.

DATA COLLECTION PROCEDURE:

Inclusion criteria include patients with clinical or electrocardiographic evidence of SVT, while exclusion criteria include patients with contraindications to adenosine, such as severe asthma or second-degree/third-degree AV block without a pacemaker. Patients were categorized into three groups based on their diagnosed arrhythmia: **Group 1** for AVNRT, **Group 2** for AVRT, and **Group 3** for atrial flutter. Baseline demographic, clinical, and electrocardiographic data were collected for each group. Each patient undergoes a thorough history and physical examination to identify potential triggers and underlying conditions. Adenosine ass administered intravenously in incremental doses (6 mg, 12 mg, 18 mg) as per clinical guidelines. Continuous ECG monitoring was performed during and after administration to document arrhythmia termination or changes in atrial activity.

ANALYSIS:

Data were analyzed using SPSS version 27. Descriptive statistics (means, standard deviations, frequencies, and percentages) summarized the baseline characteristics. The Pearson chi-squared test was used to assess associations between categorical variables, including the relationship of baseline ECG findings and rhythm transition (post-adenosine administration) with demographic variables such as gender and education level.

Normality of continuous variables was assessed using skewness, kurtosis, and the Shapiro-Wilk test. Based on these assessments, one-way ANOVA was applied to compare vital signs at presentation across rhythm transition groups and baseline ECG rhythm groups. A p-value of <0.05 was considered statistically significant.

RESULTS:

Table 1 shows the demographic characteristics of the 50 patients of SVT, including:

The study included a total of 50 participants, with 54% being male and 46% female. Regarding education level, 40% of the participants were uneducated, 26% had completed matriculation, 16% had an intermediate level of education, 12% were graduates, and 6% had postgraduate qualifications. The mean age of the participants was 34.94 years, with a standard deviation of 7.31 years.

Table 1: *Demographic characteristics of SVT patients (n=50)*

Variables	Frequency	Percent
Gender		
Male	27	54
Female	23	46
Education Level		

Uneducated	20	40
Matric	13	26
Intermediate	8	16
Graduate	6	12
Postgraduate	3	6
Age (Mean ± SD)	34.94 ± 7.31	

Table 2 shows that the most common presenting symptom among the participants was palpitations, reported by 94% of the individuals. Dizziness was experienced by 62% of the participants, while 58% reported chest pain. Fatigue was noted in 50% of the cases, and syncope was the least common symptom, occurring in 24% of the participants.

Table 2: *Symptoms of SVT patients (n=50)*

Symptoms	Frequency	Percent
Palpitations	47	94
Dizziness	31	62
Chest Pain	29	58
Syncope	12	24
Fatigue	25	50

Table 3 shows that, at presentation, the mean heart rate of the participants was 154.7 beats per minute with a standard deviation of 9.554. The average systolic blood pressure was 124.24 mmHg, while the diastolic pressure averaged 79.5 mmHg, with standard deviations of 4.443 and 4.395, respectively. The mean oxygen saturation level was 97.78% with a standard deviation of 1.020.

Table 3: *Parameters of SVT patients (n=50)*

Parameters	Mean	Std. Deviation
Heart Rate (bpm)	154.7	9.554
Blood Pressure (mmHg) Systolic	124.24	4.443
Blood Pressure (mmHg) Diastolic	79.5	4.395
Oxygen Saturation (38)	97.78	1.020

Table 4 shows the distribution of rhythm transitions after adenosine administration according to gender and education level. Among males, 10 transitioned from AVNRT to normal sinus rhythm (42)8 from AVRT to NSR, 2 experienced atrial flutter with transient block, and 6 showed no transition. Females had 13 AVNRT to NSR transitions, 5 AVRT to NSR, no atrial flutter with transient block, and 4 with no transition. The p-value for gender was 0.366, indicating no significant difference between males and females in rhythm transition. Regarding education, transitions were distributed as follows: uneducated participants showed 10 AVNRT to NSR, 4 AVRT to NSR, 1 atrial flutter transient block, and 4 no transition. Those with matriculation had 7 AVNRT to NSR, 2 AVRT to NSR, 1 atrial flutter transient block, and 3 no transition. Participants with intermediate education had 3 AVNRT to NSR, 4 AVRT to NSR, no atrial flutter transient block, and 1 no transition. Graduates showed 2 AVNRT to NSR, 2 AVRT to NSR, no atrial flutter transient block, and 2 no transition. Postgraduates had 1 AVNRT to

NSR, 1 AVRT to NSR, 2 atrial flutter transient blocks, and no cases with no transition. The p-value for education level was 0.559, suggesting no significant association between education and rhythm transition outcomes.

Table 4: *Distribution of Rhythm Transition Outcomes by Gender and Education Level of SVT patients (n=50)*

Variables	Rhythm Transition					P-Value
	AVNRT to NSR	AVRT to NSR	Atrial Flutter to Transient Block	No Transition	Total	
Gender						
Male	10	8	2	6	26	0.366
Female	13	5	0	4	22	
Education						
Uneducated	10	4	1	4	19	0.559
Matric	7	2	1	3	13	
Intermediate	3	4	0	1	8	
Graduate	2	2	0	2	6	
Postgraduate	1	1	2	0	2	

Table 5 displays the Association Between Presenting Symptoms and Rhythm Transition Post-Adenosine Administration. Palpitations were reported in 45 patients, with 23 showing AVNRT to normal sinus rhythm (42) and 12 AVRT to NSR. Other symptoms, such as dizziness, chest pain, syncope, and fatigue, showed varied distributions across rhythm transition categories. None of the symptoms showed a statistically significant association with rhythm transition, as indicated by p-values all above 0.05.

Table 5*: Association Between Presenting Symptoms and Rhythm Transition Post-Adenosine Administration (n=50)*

Symptoms		**Rhythm Transition**					**P-Value**
		AVNRT to NSR	**AVRT to NSR**	**Atrial Flutter to Transient Block**	**No Transition**	**Total**	
Palpitations	Yes	23	12	2	8	45	0.176
	No	0	1	0	2	3	
Dizziness	Yes	17	7	1	6	31	0.613
	No	6	6	1	4	17	
Chest Pain	Yes	15	7	0	6	28	0.338
	No	8	6	2	4	20	
Syncope	Yes	6	2	1	2	11	0.699
	No	17	11	1	8	37	
Fatigue	Yes	10	6	1	7	24	0.558
	No	13	7	1	3	24	

Table 6 compares vital signs at presentation across different rhythm transition groups. Heart rate means ranged from 150.8 bpm in the no-transition group to 159.23 bpm in the AVRT to NSR group, with no

significant difference observed (p=0.198). Systolic blood pressure varied between 122.08 mmHg (AVRT to NSR) and 128.5 mmHg (atrial flutter to transient block), approaching but not reaching significance (p=0.072). Diastolic blood pressure showed a statistically significant difference (p=0.028), ranging from 76.46 mmHg (AVRT to NSR) to 83 mmHg (atrial flutter to transient block). Oxygen saturation levels were similar across groups, ranging from 97% to 97.92% (p=0.700). Overall, these findings suggest only minor variations in vital signs among rhythm transition groups.

***Table 6**: Comparison of Vital Signs at Presentation across Rhythm Transition Groups (n=50)*

Vital signs at Presentation	n	Mean	Std. Deviation	P-Value
Heart Rate (bpm)				
AVNRT to NSR	23	154.739	7.300	0.198
AVRT to NSR	13	159.231	9.391	
Atrial Flutter to Transient Block	2	156.500	0.707	
No Transition		150.800	12.934	
Blood Pressure (mmHg) Systolic				
AVNRT to NSR	23	124.217	4.757	0.072
AVRT to NSR	13	122.077	3.796	
Atrial Flutter to Transient Block	2	128.500	0.707	
No Transition	10	126.300	4.057	
Blood Pressure (mmHg) Diastolic				
AVNRT to NSR	23	80.000	3.729	0.028
AVRT to NSR	13	76.462	4.427	
Atrial Flutter to Transient Block	2	83.000	1.414	
No Transition	10	81.000	4.853	
Oxygen Saturation (38)				
AVNRT to NSR	23	97.739	1.054	0.700
AVRT to NSR	13	97.923	0.954	
Atrial Flutter to Transient Block	2	97.000	1.414	
No Transition	10	97.700	1.059	

Table 7 shows the overall evaluation of the study showed that adenosine had a diagnostic accuracy of 89.75% and a therapeutic efficacy of 68.39%. The most effective dose was 6 mg. Atrioventricular nodal re-entrant tachycardia (AVNRT) was the most common arrhythmia observed, while palpitations were the most frequent symptom reported. Flushing was identified as the most common side effect following adenosine administration.

***Table 7**: Overall evaluations (n=50)*

Outcome	Value
Diagnostic Accuracy of Adenosine	89.75% overall
Therapeutic Efficacy of Adenosine	68.39% overall
Most Effective Dose	06 mg
Most Common Arrhythmia	AVNRT
Most Frequent Symptom	Palpitations

Most Common Side Effect	Flushing

Discussion

Our study found that palpitations were the most frequent symptom, affecting 94% of participants, followed by dizziness (62%), chest pain (58%), and fatigue (50%). These findings align with existing literature, which identifies palpitations as a hallmark feature of atrioventricular nodal re-entrant tachycardia (AVNRT) and atrioventricular reciprocating tachycardia (AVRT) [12,13]. Notably, syncope was less common (24%), consistent with prior research indicating that while SVT can cause significant discomfort, loss of consciousness is relatively rare [14].

The mean heart rate at presentation was 154.7 bpm, indicative of severe tachycardia typically associated with AVNRT and AVRT [15,16]. Such elevated rates can impair hemodynamic stability, particularly in ventricular arrhythmias, as supported by previous studies [16]. Despite this, blood pressure remained relatively stable (mean 124.24/79.5 mmHg), though variability in readings suggested differing individual responses to arrhythmia [17]. Additionally, oxygen saturation (97.78%) was well-maintained, reinforcing that early monitoring is crucial to prevent deterioration [18,19].

Adenosine dosing varied, with 56% receiving 6 mg, 38% requiring 12 mg, and 6% needing 18 mg. The predominance of 6 mg as the initial dose aligns with clinical guidelines, as most paroxysmal SVT cases (AVNRT/AVRT) respond to lower doses, [12,13]. However, the need for higher doses in some patients suggests individual variability in drug response, necessitating dose adjustments for refractory cases [14,20].

AVNRT (54%) was the most prevalent arrhythmia, consistent with its status as the most common paroxysmal SVT [21,22]. AVRT (30%) and atrial flutter (12%) were also significant, while 4% of cases had normal sinus rhythm, highlighting the need for precise diagnostic evaluation [20]. Adenosine demonstrated high diagnostic accuracy, correctly identifying 92.59% of AVNRT, 93.33% of AVRT, and 83.33% of atrial flutter cases, reinforcing its utility in differentiating SVT subtypes [14].

Adenosine successfully terminated 85.18% of AVNRT and 86.67% of AVRT cases, confirming its role as a first-line therapy for AV node-dependent tachycardias [13]. In contrast, only one-third of atrial flutter cases responded, as expected due to its atrial-dependent mechanism [14]. Conversion times were faster in AVNRT (15.44 ± 4.98 sec) than in AVRT (18.57 ± 6.50 sec), suggesting differences in re-entrant circuit dynamics [13].

The most common adverse effect was flushing (42%), followed by chest pain (26%), dizziness (22%), and dyspnoea (10%), consistent with adenosine's known vasodilatory effects (Katritsis, 2018). These transient reactions underscore the need for close monitoring during administration [14].

Following adenosine, 72% of patients required no further intervention, demonstrating its high efficacy [12]. However, 20% needed beta-blockers, 4% required calcium channel blockers, and 4% underwent electrical cardioversion, indicating that adjuvant therapies may be necessary in some cases [23,20].

CONCLUSION:

The current study findings confirm that adenosine is both a diagnostic and therapeutic cornerstone in SVT management, with 89.75% diagnostic accuracy and 68.39% treatment success. The 6 mg dose was effective in most cases, though dose escalation was needed in some. AVNRT was the predominant arrhythmia, and palpitations were the leading symptom. While adenosine is highly effective, clinicians must remain vigilant for transient side effects and consider alternative treatments in non-responsive cases. These insights reinforce adenosine's central role in SVT management while highlighting the importance of personalized therapeutic approaches. Thus, the findings reject the null hypothesis (H_0) and support the alternative hypothesis (H_1), confirming that adenosine plays a significant diagnostic and therapeutic role in differentiating and terminating these arrhythmias.

Recommendations:

- Observe patients for transient side effects (flushing, chest pain, dizziness) and ensure hemodynamic stability.

- Use adenosine as a diagnostic tool to differentiate AVNRT, AVRT, and atrial flutter, particularly when initial ECG findings are unclear.
- Further research should compare adenosine with other antiarrhythmics (e.g., IV beta-blockers) in terms of conversion rates and side-effect profiles.
- Investigate whether adenosine's acute success correlates with reduced recurrence rates of SVT.

How to cite: MW Rafiq, Naseem C, Hassan S; Evaluation of the Diagnostic and Therapeutic Role of Adenosine in Differentiating and Managing Atrioventricular nodal re-entrant tachycardia, Atrioventricular reciprocating tachycardia, and Atrial Flutter

References:

1. Gupta A, Lokhandwala Y, Rai N, Malviya A. Adenosine—a drug with myriad utility in the diagnosis and treatment of arrhythmias. Journal of Arrhythmia. 2021;37(1):103-12.
2. Matthews GD, Grace AA. Unmasking adenosine: the purinergic signalling molecule critical to arrhythmia pathophysiology and management. Arrhythmia & Electrophysiology Review. 2019;8(4):240.
3. Căinap S. How to Induce Arrhythmias with Adenosine? Arrhythmia Induction in the EP Lab. 2019:131-40.
4. Fidancı İ, Güleryüz OD, Yenice ÖD. Successful intraosseous adenosine administration in a newborn infant with supraventricular tachycardia. The Turkish Journal of Pediatrics. 2020;62(6):1064-8.
5. Kumar R, Gupta A, Isser HS. Narrow complex tachycardias—therapeutic and diagnostic role of adenosine. JAMA Internal Medicine. 2022;182(4):436-7.
6. Daengbubpha P, Wittayachamnankul B, Sutham K, Chenthanakij B, Tangsuwanaruk T. Comparing methods of adenosine administration in paroxysmal supraventricular tachycardia: a pilot randomized controlled trial. BMC cardiovascular disorders. 2022;22(1):15.
7. Karcıoğlu Ö. Recognition and Management of Supraventricular Arrhythmias and Atrial Fibrillation in the Acute Setting. Atrial Fibrillation-Diagnosis and Management in the 21st Century: IntechOpen; 2022.
8. Long B, Robertson J, Koyfman A, Maliel K, Warix JR. Emergency medicine considerations in atrial fibrillation. The American journal of emergency medicine. 2018;36(6):1070-8.
9. Yu J-h, Yu P, Jiang Y, Hong K, Yan G-X. Narrow-QRS Tachycardias: Differential Diagnosis at Bedside. Management of Cardiac Arrhythmias. 2020:171-87.
10. Boehmer AA, Rothe M, Soether CM, Kaess BM, Ehrlich JR. Supraventricular Tachycardia: Electrocardiogram Diagnosis and Clinical Management for the Non-electrophysiologist. 1. 2021.
11. Katritsis DG, Arbelo E, Arribas F, Bax JJ, Blomstrom-Lundqvist C, Calkins H, et al. 2019 ESC Guidelines for the management of patients with supraventricular tachycardia. European Heart Journal. 2020;41:655À720.
12. Katritsis DG. Catheter Ablation of Atrioventricular Nodal Re-entrant Tachycardia: Facts and Fiction. Arrhythm Electrophysiol Rev. 2018;7(4):230-1.
13. González-Casal D, Pérez-Castellanos A, Flores NS, Carta-Bergaz A, González-Torrecilla E, Bruña Fernández V, et al. Cannon A wave validation as a diagnostic tool in paroxysmal supraventricular tachycardias. Pacing and Clinical Electrophysiology. 2024;47(3):383-91.
14. BREMBILLA-PERROT B, MARCON F, BOSSER G, LUCRON H, HOURIEZ P, CLAUDON O, et al. Paroxysmal Tachycardia in Children and Teenagers with Normal Sinus Rhythm and Without Heart Disease. Pacing and Clinical Electrophysiology. 2001;24(1):41-5.
15. Hamid A, Sonali, T.A., Rehan, R., Biswas, P., Datta, S.C. and Zaman, A. . Evaluation of AVNRT & AVRT by Different Criteria: Old & New. World Journal of Cardiovascular Surgery, 14, 95-106. (2024)
16. Akbuğa K EM, Karanfil M, Aslan T, Can İ. . Value of Age and Sex in Differential Diagnosis of Supraventricular Tachycardia. Koşuyolu Heart Journal 2019;22(3):162-7.
17. Elbatran AI, Zarif JK, Tawfik M. Anterograde His bundle activation during right ventricular overdrive pacing in supraventricular tachycardia. Pacing and Clinical Electrophysiology. 2019;42(10):1374-82.

18. Zeytin A, Konca, Ç., Varan, C. (2023). . Efficacy of Adenosine in the Differential Diagnosis of Narrow QRS Complex Tachyarrhythmia: A Case Diagnosed with Atrial Flutter After Adenosine. . Journal of Pediatric Emergency and Intensive Care Medicine, 10(2), 143-146.
19. Guido Lopez LE, Martinez Cossiani M, Merino D, Martinez Maldonado ME, Castrejon Castrejon S, Jauregui Abularach M, et al. Are reentrant atrial tachycardias sensitive to adenosine administration? EP Europace. 2023;25(Supplement_1).
20. Brenes. A Caveat during Adenosine Challenge. . Cardiovascular Journal. 2013.
21. Zolotarova TV BM, Yabluchanskiy MI. . Functional classes and clinical characteristics of chronic heart failure in patients with atrial fibrillation and/or flutter after radiofrequency ablation. Вестник Харьковского национального университета имени ВН Каразина Серия «Медицина» 2018(35):72-7.
22. Goyal A, Mashru, P., Sharma, R., Sethiya, B., & Jain, A. . Prevalence of wpw syndrome among all supra ventricular tachycardia patients in a tertiary care hospital in rajasthan. ijsr, 70-71. (2024). .
23. Riccardi A, Arboscello E, Ghinatti M, Minuto P, Lerza R. Adenosine in the treatment of supraventricular tachycardia: 5 years of experience (2002-2006). The American Journal of Emergency Medicine. 2008;26(8):879-82.