World Journal of Pharmaceutical and Life Sciences
WJPLS
www.wjpls.org
SJIF Impact Factor: 6.129

# COMPARISON BETWEEN ADENOSINE AND VERAPAMIL IN TREATMENT OF PAROXYSMAL SUPRAVENTRICULAR TACHYCARDIA AMONG IRAQI PATIENTS IN AL-YARMOUK TEACHING HOSPITAL

**Riyam Adnan Alwan[1]* and Abbas Naji Al-Sharifi[2]**

[1]M.B.Ch.B, Baghdad- Iraq.
[2]M.B.Ch.B, F.R.C.P, F.A.C.C, F.E.S.C, F.I.C.M.S, Baghdad- Iraq.

***Corresponding Author: Dr. Riyam Adnan Alwan**
M.B.Ch.B, Baghdad- Iraq.

**Article Received on 08/01/2024** **Article Revised on 28/01/2024** **Article Accepted on 18/02/2024**

## ABSTRACT

**Background:** Paroxysmal supraventricular tachycardia is a clinical syndrome of rapid regular tachycardia with an abrupt onset and termination. Acute management includes controlling the rate and preventing hemodynamic collapse. Adenosine has been classified as a miscellaneous antiarrhythmic drug outside the Vaughan- Williams classification scheme. Verapamil has a longer half-life than adenosine and may help to maintain sinus rhythm following the termination of supraventricular tachycardia. **Aim of study:** To detect the difference in response to treatment of patients with paroxysmal supraventricular tachycardia to either adenosine or verapamil for reaching to sinus rhythm. **Methods:** A comparative clinical trial study that conducted in the Emergency Department for a period of six months from 15th of Feb. till 15th of Aug. 2021. It included 60 adult patients who were admitted to the emergency department with paroxysmal supraventricular tachycardia and whose condition failed to respond to vagal maneuvers. They were divided into two groups: Adenosine group included 30 adult patients received adenosine shoots and verapamil group included 30 adult patients received verapamil ampule shoots. Follow up continued for six hrs. for all patients in the emergency department under continuous cardiac monitoring. If the rhythm on the monitor changed, an ECG was taken immediately and if the new ECG showed the recurrence of paroxysmal supraventricular tachycardia, the patient was treated accordingly. Measurement of blood pressure was done every 5– 10 mints. Baseline vital signs and ECG findings were recorded before intervention and then 30 and 120 mints. after rhythm control. **Results:** In this study, the time required for conversion of paroxysmal supraventricular tachycardia to sinus rhythm was significantly shorter in adenosine group than that in verapamil group. There was no treatment failure among certain group that necessitated the administration of the other group item. **Conclusion:** Adenosine was superior to verapamil in the management of supraventricular tachycardia as it has rapid onset of action. Verapamil still good option for the treatment of supraventricular tachycardia where adenosine is not available.

**KEYWORDS:** Supraventricular tachycardia, Paroxysmal, Adenosine, Verapamil, Treatment, Iraq.

## INTRODUCTION

Supraventricular tachycardia (SVT) is a heterogeneous group of arrhythmias used to describe tachycardias that involve cardiac tissue at the level of the bundle of His or above.[1] SVTs represent a range of tachyarrhythmia originating from a circuit or focus involving the atria or the atrioventricular node. The term paroxysmal SVT (PSVT) denotes a subset of SVTs that present as a clinical syndrome of rapid regular tachycardia with an abrupt onset and termination. SVTs are usually narrow-complex tachycardias with a QRS interval of 100 ms or less on an electrocardiogram (ECG).[2] Occasionally, they may show a wide QRS complex in the case of a pre-existing conduction delay, an aberrancy due to rate-related conduction delay or a bundle branch block. SVT is a common cause of hospital admissions and can cause significant patient discomfort and distress. Depending on the site of origin of the dysrhythmia, SVT may be classified as an atrial or AV tachyarrhythmia. Another way to separate the arrhythmias is to classify them into conditions having either regular or irregular rhythms.[3–5]

- Atrial in Origin and Regular Rhythm: sinus tachycardia, inappropriate sinus tachycardia, sinoatrial nodal reentrant tachycardia, and atrial flutter.
- Atrial in Origin and Irregular Rhythm: multifocal atrial tachycardia, atrial flutter with variable block, atrial fibrillation.
- AV Node in Origin and Regular Rhythm: junctional

tachycardia, atrioventricular nodal reentrant tachycardia, atrioventricular reentrant tachycardia.

- ❖ AV-nodal reentrant tachycardia (AVNRT) is the most common SVT in the general population and accounts for over 60% of patients undergoing invasive cardiac electrophysiology study. It is facilitated by the presence of two functionally distinct electrophysiological tracts of differing conduction velocities and refractory periods within the AV node: a fast pathway and a slow pathway.[3] An atrial (or less commonly a ventricular) premature beat is required to initiate repetitive re-entry between the fast and slow pathways, manifest on the surface ECG as a narrow QRS tachycardia in the absence of bundle branch block. For the most common form of AVNRT, P-waves are not easily seen on the surface ECG during tachycardia due to almost simultaneous activation of the atria and ventricles.[1]
- ❖ In Atrioventricular reentrant tachycardia (AVRT), one critical limb of the circuit is the AV node, while the other consists of an embryological remnant connecting the atria and ventricle, the accessory pathway (AP).[6] These extra- nodal connections may conduct exclusively from atrium to ventricle (manifest ventricular pre-excitation or Wolff–Parkinson–White pattern ECG), from ventricle to atrium (not visible on sinus rhythm ECG and referred to as 'concealed') or be capable of conduction in both directions.[7] Approximately 90% of AVRTs are orthodromic, in which the impulse travels from atrium to ventricle via the AV node and from ventricle to atrium via the AP. Retrograde P-waves are often visible after and separate from the QRS.[8] (Figure 1.1)

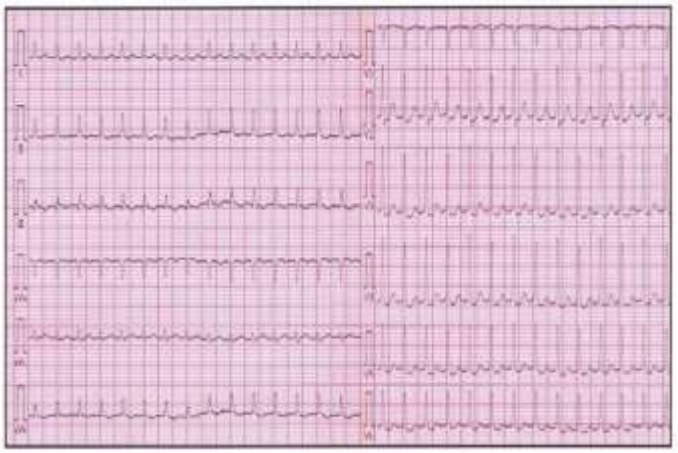

**Figure 1.1: Strip rhythm of supraventricular tachycardia.**

SVT can be precipitated by certain risk factors include.[9,10]

- Age; Some types of SVT are more common in people who are middle-aged or older.
- Coronary artery disease, heart failure, cardiomyopathy, valvular heart disease, prior cardiac surgery, all increase the risk of developing SVT.
- Congenital heart disease.
- Drugs and supplements; as certain over-the-counter cough and cold medicines.
- Anxiety or emotional stress.
- Physical fatigue.
- Diabetes.
- Obstructive sleep apnea.
- Nicotine and illegal drug use.
- Thyroid problems; having an overactive or underactive thyroid gland can increase the risk of SVT.

Regarding epidemiology of PSVT, the incidence of SVT is approximately 35 cases per 100,000 patients with a prevalence of 2.25 cases per 1,000 in the general population. Atrial fibrillation and atrial flutter are the most common subtypes of SVT, affecting approximately 2 million patients in the united states.[11] PSVT is observed not only in healthy individuals; it is also common in patients with previous myocardial infarction, mitral valve prolapses, rheumatic heart disease, pericarditis, pneumonia, chronic lung disease, and current alcohol intoxication.[12] Most series of catheter ablation reflect a higher proportion of female patients with AVNRT than male patients. The risk of developing PSVT was found to be twice in women compared to men in a population-based study, with the prevalence of the PSVT higher with age. SVT diagnosis is suspected by the presentation of sudden onset palpitation and is confirmed by.

Electrocardiography (ECG): ECG findings permit classification of the tachyarrhythmia, and they may allow a precise diagnosis. P waves may not be visible; when present, they may be normal or abnormal, depending on the mechanism of atrial depolarization. ECG characteristics of the various SVTs are as follows.[5,13,14]

- ✓ Sinus tachycardia - Heart rate greater than 100 bpm; P waves similar to sinus rhythm.

- ✓ Inappropriate sinus tachycardia (IST) - Findings similar to sinus tachycardia; P waves similar to sinus rhythm.
- ✓ Sinus nodal reentrant tachycardia (SNRT) - P waves similar to sinus rhythm; abrupt onset and offset.
- ✓ Atrial tachycardia - Heart rate 120-250 bpm; P-wave morphology different from sinus rhythm; long RP interval (in general); AV block does not terminate tachycardia.
- ✓ Multifocal atrial tachycardia - Heart rate 100-200 bpm; 3 or more different P-wave morphologies.
- ✓ Atrial flutter- Atrial rate of 200-300 bpm; flutter waves; AV conduction of 2:1 or 4:1.
- ✓ Atrial fibrillation - Irregularly irregular rhythm; lack of discernible P waves.
- ✓ AVNRT - Heart rate of 150-200 bpm; P wave located either within the QRS complex or shortly after the QRS complex; short RP interval in typical AVNRT and long RP interval in atypical AVNRT.
- ✓ AVRT - Heart rate of 150-250 bpm; narrow QRS complex in orthodromic conduction and wide QRS in antidromic conduction.

- The remaining investigations should be done accordingly.
- Laboratory studies; a cardiac enzyme evaluation should be ordered for patients with chest pain, patients with risk factors for myocardial infarction, and patients who are otherwise unstable and present with heart failure, hypotension, or pulmonary edema. Other laboratory tests include electrolyte levels, complete blood count, digoxin level, and thyroid studies.[12]

- Chest radiography: obtain a chest radiograph to assess for the presence of pulmonary edema and cardiomegaly. In certain cases, infections such as pneumonia are also associated with PSVT and can be confirmed with chest radiography.[15]

- Transthoracic echocardiography: a transthoracic echocardiogram may be helpful if structural or congenital heart disease is suggested.[2]

- Holter monitoring also may be useful as it can help to assess the frequency and duration of SVT episodes.[2]

- Electrophysiology: the ultimate test of PSVT is an electrophysiological (EP) study. This test not only diagnoses the condition but also identifies the precise cause. A diagnostic EP study is always done before catheter ablation, usually as part of the same procedure. With the patient under light sedation. Fine wires inside the catheter can help pinpoint any areas outside the sinus node that produce electrical signals, then remove them using catheter ablation.[3]

- Magnetic resonance imaging: cardiac magnetic resonance imaging (MRI) can be useful, especially if a congenital heart disease is being considered.[12]

Regarding management of PSVT cases, acute management of PSVT includes controlling the rate and preventing hemodynamic collapse. If the patient is hypotensive or unstable, immediate cardioversion with sedation must be performed.

If the patient is hemodynamically stable, vagal maneuvers can be attempted in the first instance. For the Valsalva maneuver, SVT termination rates vary dramatically from 19% to 54%, with the REVERT trial demonstrating a significant improvement when performed in the semi-recumbent position.[9,26] If carotid sinus massage is being performed, the patient's neck must be extended and turned away. The carotid sinus can then be located behind the angle of the jaw.[1] Firm pressure should be applied unilaterally for no longer than 5 seconds and the maneuver avoided in patients with known carotid artery disease, previous transient ischemic attack / stroke and carotid bruits. This can be performed in the lying and sitting position and on both sides.[17,18] If vagal maneuvers are not successful, adenosine can be used in increasing doses. If adenosine does not work, atrioventricular nodal blocking agents like calcium channel blockers or beta-blockers should be used, as most patients who present with PSVT have AVNRT or AVRT.[12] Adenosine has been classified as a miscellaneous antiarrhythmic drug outside the Vaughan-Williams classification scheme. It acts on receptors in the cardiac AV node, significantly reducing conduction time. This effect occurs by activation of specific potassium channels. Adenosine challenge can be administered via a large peripheral/central vein as a bolus immediately followed by a 10 mL rapid saline flush. Delivery to the myocardium must be swift as the half-life of adenosine is less than 10 seconds.[12]

Concerning verapamil, it is in the non–dihydropyridine calcium channel blocker family of medications. Verapamil was approved for medical use in the United States in 1981.[19] It is on the World Health Organization's List of Essential Medicines.

Verapamil blocks voltage-dependent calcium channels. In cardiac pharmacology, calcium channel blockers are considered class-IV antiarrhythmic agents. Since calcium channels are especially concentrated in the sinoatrial and atrioventricular nodes, these agents can be used to decrease impulse conduction through the AV node, thus protecting the ventricles from atrial tachyarrhythmia. Verapamil has a longer half-life than adenosine and may help to maintain sinus rhythm following the termination of SVT. It is also advantageous for controlling the ventricular rate in patients with atrial tachyarrhythmia[2] In a randomized clinical trial of 92 patients with PSVT, oral verapamil can decrease recurrence of PSVT after successful control with intravenous adenosine. Patients in the adenosine-only group received adenosine; patients in the

adenosine/verapamil group received adenosine and then received oral verapamil immediately after conversion of the rhythm to sinus rhythm. The adenosine / verapamil group had a significantly lower recurrence rate than the adenosine-only group between (30 and 120 minutes) post-treatment and thereafter.[20] Beta- blockers are less efficacious at terminating the arrhythmia. Both drug groups should be used cautiously in patients with decompensated heart failure and hypotension.[21] For long-term management of SVT and improving quality of life, reduced hospital attendances and cost burden make catheter ablation a particularly desirable option as first line therapy for all SVTs, especially in AVNRT and AVRT where documented cure rates can exceed 95% with an associated risk of <1% for major complications.[7]

**Literature review**

- Paroxysmal supraventricular tachycardia (paroxysmal SVT) is an episodic condition with an abrupt onset and termination.

- SVT in general is any tachyarrhythmia that requires atrial and/or atrioventricular (AV) nodal tissue for its initiation and maintenance. It is usually a narrow-complex tachycardia that has a regular, rapid rhythm.

- Rehorn MD et al constructed an observational longitudinal study in united states from 2008-2016 where the analysis revealed the period prevalence and incidence of PSVT were 332.9 (323.2_ 342.9) and 57.8 (52.8 – 63.3) per 100000 individuals respectively, projected to the 2018 US Census, prevalence and incidence are 1.26 million (1.21–1.30 million) and 188,981 (172,891– 206,943), respectively.[22]

- Initial treatment often involves increasing vagal tone by performing the Valsalva manoeuver, which is effective in 50% of cases that showed in smith GD et AL study,[23] A modification of Valsalva manoeuver in which the patient is placed in supine position with the legs elevated has been found in Appelboam et al who did a randomized controlled, parallel group trial at emergency department in England in 2015, found this manoeuver to be more effective with a success rate of 43%.[16]

- A retrospective observational study was done by Piercalo Ballo et al from 2000-2004 where 106 patients has been enrolled, they concluded that heart rate predicts restoration of sinus rhythm in patients with episodes of PSVT, found that Adenosine is highly effective in PSVT characterized by fast rates whereas the efficacy of verapamil is increased in patients with low frequency PSVT.[24]

- Lim S. H. et al study published in 2009 conducted a randomized controlled trial where 206 patients with SVT has been enrolled of these 102 received calcium channel blocker (verapamil=48 / diltiazem =54), and 104 patients treated with adenosine, of these 14 patients not converted by 6 mg and 12 mg of adenosine, 9 of them were successfully converted with verapamil infusion and 5 with diltiazem infusion. concluded that slow infusion of calcium channel blocker is an alternative to adenosine in treatment of supraventricular tachycardia.[25]

- Dogan et al accomplished a retrospective observational study in Istanbul between 2011-2013in which 77 patients enrolled having a narrow QRS complex and found that diltiazem is more effective than adenosine in reversion rate to sinus rhythm, Conversion with the first dose of 6mg adenosine in 59.6% (34/57) versus conversion with the first dose of 0.25 mg/kg diltiazem in 95% (19/20) were found (P = 0.000).[26]

- A randomized controlled trial was done in 2017 where 56 patients included by Sarah brubaker et al in the department of emergency medicine, the university of Texas demonstrated that nondihydropyridine calcium channel blocker (verapamil and Diltiazem) are equally as efficacious as adenosine in converting AVNRT to sinus rhythm.[27]

- Seven randomized controlled trials were reviewed in 2017 by Samer Al Abed et al, with 622 participants who came in the emergency department with SVT, moderate quality evidence showed no differences in the number of patients reverting to sinus rhythm who were treated with adenosine or CCA (89.7% vs 92.9%; OR 1.51, 95% confidence interval (CI) 0.85 to 2.68.[28]

**Aim of study**

To detect the difference in response to treatment of patients with paroxysmal supraventricular tachycardia to either adenosine or verapamil for reaching to sinus rhythm.

**PATIENTS AND METHODS**

- The study design was a comparative clinical trial study that conducted in the Emergency Department at Al-Yarmouk Teaching Hospital for a period of six months from 15th of Feb. till 15th of Aug. 2021.
- This study included a sample size of 60 adult patients who were admitted to the emergency department with paroxysmal SVT and whose condition failed to respond to vagal maneuvers. The patients were informed about the nature of the study and verbal consent was obtained from them. They were divided randomly into two groups:

- **Adenosine group:** Included 30 adult patients received one ampule adenosine shoot of (6 mg), if no response after two minutes then two ampules (12

mg), if no response after two minutes then two ampules (12 mg).

- **Verapamil group:** Included 30 adult patients received one ampule verapamil shoot of (5 mg), repeated two times every 5 - 10 minutes if no response.

Paroxysmal SVT suspicion is based on the rapid onset of symptoms and electrocardiogram (ECG) evidence of regular narrow complex tachycardia.

**Exclusion criteria**

- ✓ Patients whose attack of SVT was terminated by Valsalva maneuver only.
- ✓ Patients whose ECG showed SVT with BBB (QRS > 120ms.).
- ✓ Patients who were dynamically unstable (BP ≤ 90/60 mmHg), chest pain, decreased level of consciousness, or pulmonary edema due to congestive heart failure).
- ✓ Patients received any antiarrhythmic drugs before Emergency Department presentation.
- ✓ Patients with known allergy to adenosine or verapamil.
- ✓ Patients with a contraindication to verapamil or adenosine (any evidence of severe heart failure, sick sinus syndrome, severe asthma).
- ■ A questionnaire was applied to all enrolled patients to collect the needed information which filled by the researcher. It included questions to gather the following information:
- ✶ Age and gender
- ✶ Past medical history.
- ✶ Drug history.
- ✶ Smoking status
- ✶ History of previous catheter ablation.
- ✶ This questionnaire included measuring weight and height to calculate Body Mass Index (BMI) level, which is calculated by weight in (kilograms) divided by the square of height in (meters).
  BMI = Weight (Kg) / Square height ($m^2$) [32].
  Patients were classified according to BMI as:
- ✓ Normal (≤ 24.99 $kg/m^2$)
- ✓ Overweight (25 - 29.99 $kg/m^2$)
- ✓ Obese (≥ 30 $kg/m^2$)
- ✶ Number of ampules required to achieve sinus rhythm.
- ✶ Duration required to achieve sinus rhythm.
- ✶ Echo findings
- ✶ Investigation results.

**Regarding the work up**

- ➢ Detailed history was taken and physical examination including vital signs were done for all study patients.
- ➢ Electrocardiogram and Echo study were done for all study patients.
- ➢ A blood sample was taken from all patients to perform the following investigation:
  - ○ Complete blood count, renal function test, and random blood sugar.
  - ○ Thyroid function test
  - ○ S. Na level (Na levels of 135 - 145 mmol/L was considered as normal).[30]
  - ○ Regarding S.K level couldn't be involved in the study, as there was sampling error for some cases during ER presentation.
- ➢ Patients with paroxysmal SVT were first underwent vagal maneuvers under cardiac monitoring. If the maneuvers were failed, patients then included in this study. Then the patients were either:
  - ○ Received one ampule (6 mg) adenosine as a rapid bolus intravenous injection by the peripheral route followed by a rapid saline flush. If the first dose didn't eliminate the PSVT within 1–2 min, 12 mg adenosine was administered intravenously again and then this 12 mg dose was repeated for a second time if required (Adenosine group).
  - ○ Or received one ampule verapamil shoot of (5 mg), repeated three times every 5 - 10 minutes if no response (Verapamil group).
- ➢ Follow up continued for six hrs. for all patients in the emergency department under continuous cardiac monitoring. If the rhythm on the monitor changed, an ECG was taken immediately and if the new ECG showed the recurrence of paroxysmal SVT, the patient was treated accordingly.
- ➢ Measurement of blood pressure was done every 5–10 mints. Baseline vital signs and ECG findings were recorded before intervention and then 30 and 120 minutes after rhythm control.

**Statistical analysis**

- ❖ The data were analyzed by using Statistical Package for Social Sciences (SPSS) version 26. The data presented as mean, standard deviation and ranges. Categorical data presented by frequencies and percentages. Independent t-test (two tailed) was used to compare the continuous variables accordingly. A level of P – value less than 0.05 was considered significant.

❖ **Ethical considerations and official approvals**

The information was anonymous. Names were removed and replaced by identification codes. All information kept confidential in a password secured laptop and data used exclusively for the research purposes.

**Administrative approvals were granted from the following**

1. The Council of Arab Board of Health Specialization.
2. Approval and agreement of Internal Medicine Department at Al-Yarmouk Teaching Hospital.

**RESULTS**

A total of 60 patients with confirmed PSVT were recruited in this study. They were allocated into two groups (30 patients in each group) to receive injection of either Adenosine (Adenosine Group), or Verapamil

(Verapamil Group).

In this study as shown in (Table 3.1), 53.3% of the patients in adenosine group were females versus 46.7% males, while female patients in verapamil group were 56.7% versus 43.3% males. In adenosine group, patient's age ranged from 20 to 65 years with a mean of 41.73 and standard deviation (SD) of ± 12.8 years, and 16 (53.3%) of patients were found in the age group of (30 – 50) years. In verapamil group, patient's age ranged from 27 to 60 years with a mean of 43.20 ± 11.67 years, and 13 (43.3%) aged (30 – 50) years. The BMI of adenosine group had a mean of 28.76 ± 3.33 kg/m$^2$, and 14 (46.7%) of cases were overweight, while mean BMI of verapamil group was 27.27 ± 1.59 kg/m$^2$, and 26 cases (86.6%) were overweight. In this study, 15 (50%) of adenosine group and 18 (60%) of verapamil group had a history of medical diseases like HT, DM, thyroid dysfunction, IHD.

Abnormal Echo findings was recorded among 3 patients in adenosine group (two cases had LVH and one case had MVP), and among 6 patients in verapamil group (four cases had LVH and two cases had MVP). The duration of having attacks of PSVT ranged from (1 – 3) years in 20 (66.7%) and 19 (63.4%) of cases in adenosine and verapamil groups, respectively. In adenosine group, 6 mg bolus was administered to 17 patients (56.7%), 18 mg was administered to 11 (36.7%), while only two case (6.6%) required 30 mg adenosine. In verapamil group, one dose (5 mg) was given to 19 patients (63.3%), while the remaining 11 (36.7%) required two doses (10 mg) verapamil. 5 (16.7%) of patients in adenosine group gave a history of prior catheter ablation.

**Table 3.1: Demographic findings and clinical characteristics of PSVT patients.**

| Demographic and Clinical Characteristics | Study Groups | | Total (%) n= 60 |
|---|---|---|---|
| | Adenosine (%) n= 30 | Verapamil (%) n= 30 | |
| **Gender** | | | |
| **Male** | 14 (46.7) | 13 (43.3) | 27 (45.0) |
| **Female** | 16 (53.3) | 17 (56.7) | 33 (55.0) |
| **Age (Years)** | | | |
| **< 30** | 6 (20.0) | 5 (16.7) | 11 (18.3) |
| **30 - 50** | 16 (53.3) | 13 (43.3) | 29 (48.4) |
| **> 50** | 8 (26.7) | 12 (40.0) | 20 (33.3) |
| **BMI Level** | | | |
| **Normal** | 4 (13.3) | 2 (6.7) | 6 (10.0) |
| **Overweight** | 14 (46.7) | 26 (86.6) | 40 (66.7) |
| **Obese** | 12 (40.0) | 2 (6.7) | 14 (23.3) |
| **Comorbidities** | | | |
| **Yes** | 15 (50.0) | 18 (60.0) | 33 (55.0) |
| **No** | 15 (50.0) | 12 (40.0) | 27 (45.0) |
| **Echo Findings** | | | |
| **Normal** | 27 (90.0) | 24 (80.0) | 51 (85.0) |
| **MVP** | 1 (3.3) | 2 (6.7) | 3 (5.0) |
| **LVH** | 2 (6.7) | 4 (13.3) | 6 (10.0) |
| **Duration of PSVT (Years)** | | | |
| **< 1** | 2 (6.7) | 3 (10.0) | 5 (8.3) |
| **1 – 3** | 20 (66.7) | 19 (63.4) | 39 (65.0) |
| **> 3** | 8 (26.6) | 8 (26.6) | 16 (26.7) |
| **Drug Dosage** | | | |
| **One Dose** | 17 (56.7) | 19 (63.3) | 36 (60.0) |
| **Two Doses** | 11 (36.7) | 11 (36.7%) | 22 (36.7) |
| **Three Doses** | 2 (6.6) | 0 (0) | 2 (3.3) |
| **Previous Catheter Ablation** | | | |
| **Yes** | 5 (16.7) | 0 (0) | 5 (8.3) |
| **No** | 25 (83.3) | 30 (100.0) | 55 (91.7) |

Regarding the comparison between the study groups by certain demographic and baseline characteristics that demonstrated in (Table 3.2) showing no statistically significant difference in age (P= 0.278), gender (P= 0.795), BMI (P= 0.083), and comorbid conditions (P= 0.436) among both groups.

**Table 3.2: Comparisonbetween study groups by age, gender, BMI, and Comorbidities.**

| Demographic and Baseline Characteristics | Study groups | | P - Value |
|---|---|---|---|
| | Adenosine Mean ± SD | Verapamil Mean ± SD | |
| Age (Years) | 41.73 ± 12.83 | 43.20 ± 11.67 | 0.278 |
| BMI (kg/m$^2$) | 28.76 ± 3.33 | 27.27 ± 1.59 | 0.083 |
| Gender | no. (%) | no. (%) | |
| Male | 14 (46.7) | 13 (43.3) | 0.795 |
| Female | 16 (53.3) | 17 (56.7) | |
| Comorbidities | | | |
| Yes | 15 (50.0) | 18 (60.0) | 0.436 |
| No | 15 (50.0) | 12 (40.0) | |

In (Table 3.3) revealing the comparison in response to treatment between the study groups. In adenosine group, the time required for conversion of PSVT to sinus rhythm was significantly shorter than that in verapamil group (3.5 minutes versus 6.97 minutes, P= 0.039). Insignificant difference was found regarding the whole duration of having attacks of PSVT between the two groups.

**Table 3.3: Comparison in response to treatment between the study groups.**

| Variable | Study groups | | P - Value |
|---|---|---|---|
| | Adenosine Mean ± SD | Verapamil Mean ± SD | |
| Time for Conversion to S.R (min.) | 3.50 ± 4.35 | 6.97 ± 7.88 | 0.039 |
| Duration of developing attacks of PSVT (Year) | 3.56 ± 4.76 | 2.14 ± 1.82 | 0.134 |

In (Table 3.4) demonstrating the laboratory results which is done for all patients in this study including (thyroid function test, hemoglobin level, S. Na). All the results were normal. but regarding the comparison, Adenosine group had higher mean levels of HB, serum Na, and TSH compared with the verapamil group (13.15 mg/dl versus 12.64 mg/dl, 139.7 mEq/L versus 137.2 mEq/L, and 2.95 µIU/l versus 1.53 µIU/l, respectively. Patients in adenosine group had lower mean levels of T4 and T3 compared to those in the verapamil group (1.65 ng/dl versus 1.74 ng/dl, and 1.20 versus 1.81 ng/dl, respectively.

**Table 3.4: Results of certain laboratory parameters among the study patients.**

| Laboratory Parameters | Study groups | |
|---|---|---|
| | Adenosine Mean ± SD | Verapamil Mean ± SD |
| TSH (µIU/ml) | 2.95 ± 1.33 | 1.53 ± 1.90 |
| T4 (ng/dl) | 1.65 ± 1.79 | 1.74 ± 1.37 |
| T3 (ng/ml) | 1.20 ± 0.29 | 1.81 ± 1.95 |
| Hb (gm/dl) | 13.15 ± 1.58 | 12.64 ± 1.24 |
| S. Na (mEq/L) | 139.7 ± 2.66 | 137.2 ± 2.12 |

**Treatment Failure and Side effects**

There was no treatment failure among certain group that necessitated the administration of the other group item. Probably because the doctors who were in charge of the management in emergency room infused the medication in time and followed the proper way of administration including the accurate interval between doses. Also there was no recurrence of attacks after conversion to sinus rhythm in each group during their admission in ER.

No side effects like shortness of breath, chest pain, dizziness or hypotension was happened after infusion of antiarrhythmic agents among both groups.

**DISCUSSION**

PSVT is one of the commonly encountered arrhythmia in emergency department, the attacks can be initially terminated by non-pharmacological maneuvers. if these measures failed, then intravenous adenosine or verapamil are the most agents used to terminate the attack.

In present study, 53.3% of the patients in adenosine group were females, while in verapamil group female were 56.7%. This consistent with Gill et al study in 2014, where 120 patients with PSVT were included. Out of these, 74 (61.7%) were females and 46 (38.3%)were males. All the patients were divided in two groups. In group-A (adenosine group), 24 (40%) patients were male and 36 (60%) patients were female.

In Group-B (verapamil group), 22 (36.7%) patients were male and 38 (63.3%) patients were female.[31] As compared to Shaker et al study in 2015, a different demographic findings reported, in which male patients

out-numbered the females, as they constituted 57.6% of enrolled patients.[20] For explaining the reason behind higher female proportion, It was shown that AVNRT as it is the most common type of PSVT has a 2:1 women-to-men predominance. where a shorter refractory period of the slow pathway has been described in women and may explain this higher incidence.

In adenosine group, mean and standard deviation (SD) of age was 41.73 ± 12.8 years, ranged from 20 to 65 years, and 53.3% of them aged between (30 – 50) years.

In verapamil group, mean and SD of age was 43.20 ± 11.67 years, ranged from 27 to 60 years, 43.3% of them aged (30 – 50) years. Similarly, in Athar et al study in 2013, conducted on 200 patients with PSVT in Pakistan, a close result published in which mean and SD of age in group A (adenosine group) was 42.8 ± 13.9 years and in group B (verapamil group) was 40.5 ±15 years.[32] Differently in Gill et al study that involved 120 patients, the mean age of patients found to be younger, in Group-A The mean was 28.90±11.04 with an age range of 17–56 years and in Group-B the mean age of patients was 32.38±12.07.[31] The prevalence of PSVT is higher in elderly may due to age-related changes in atrial and nodal physiology in later decades (as cellular coupling and autonomic influences).[33]

Discussing the response to treatment between both groups in our study that revealed, in adenosine group, the time required for conversion to sinus rhythm was significantly shorter than verapamil group (P= 0.039). Besides that, each item has been succeeded in terminating the attacks in both groups where the success rate was 100%, this consistent with Athar et al study in 2013 conducted in emergency department of Punjab institute of cardiology in Pakistan, where 200 patients allocated in 2 groups and received either adenosine or verapamil. In which the mean time elapsed since injection of adenosine up to the termination of the attack was significantly shorter than that of verapamil 2.1 minutes' vs 5.1 minutes (P value < 0.0001). and the success rate was 96% and 95% for adenosine and verapamil group respectively.[32] Similarly, in Cheng et al study which is a randomized multicenter trial in 2003, where 122 patients with PSVT entered the trial and 2 groups allocated to receive either sequential doses of 3,6,12 mg of adenosine in one group and intravenous 5 mg or additional 5mg of verapamil in the second group, they found that the average time after injection of medication until conversion to sinus rhythm in adenosine group was shorter than verapamil group (P< 0.0001).[34] This significant difference in time for sinus rhythm restoration was due to rapid onset of action of adenosine that leads to rapid conversion to sinus rhythm whereas verapamil takes longer time to be metabolized and exert its action.[32] In present study, 56.7% in adenosine group were converted from the first bolus of 6 mg and 36.7% converted with additional 12 mg. In verapamil group, 63.3% has been terminated by first 5 mg bolus and 36.7% converted by additional 5 mg. Consistently, with Riaz et al study in 2012, they reported a similar finding as 60% of patients in adenosine group were converted with 6 mg bolus and 18.89% converted with an additional 12 mg. In verapamil group, 82.22% of patients were converted with 5 mg bolus dose and 8.89% converted to sinus rhythm by second 5 mg dose of verapamil.[35]

Regarding treatment efficacy in terminating the attack of arrhythmia in the current study, there was no treatment failure among each group that required the administration of the other group item. Similar high rate of conversion to sinus rhythm was found in Athar et al study where 96% of patients in adenosine group and 95% in verapamil group has been reverted to sinus rhythm. By comparison to other studies, in Gill et al study in 2014, didn't match with our finding, in which a total of 120 patients enrolled in the study that accomplished in Chundry Pervaiz institute of cardiology in Lahore, Pakistan. Where 60 patients in adenosine group in whom the termination of PSVT was observed in 56 (93.3%) patients. While the remaining 4 (6.7%) patients did not show termination. Among the 60 patients in verapamil group, there were 43 (71.6%) patients in whom PSVT was terminated, while 17 (28.4%) patients did not show termination of the attack.[31] Moreover, results in Riaz et al study in 2012 were not consistent with our finding regarding treatment failure, in which 180 patients enrolled in the study and divided into two groups, 54 (60%) patients in adenosine group were converted to sinus rhythm with 6 mg bolus. 17 (18.89%) patients converted to sinus rhythm with additional 12 mg bolus. Of the remaining 19 patients not converted with adenosine, 9 converted with 5 mg of verapamil and 10 converted with additional 10 mg. while in 90 patients in verapamil group, 74 patients (82.22%) were converted to sinus rhythm with 5 mg dose. 8 patients (8.89%) converted to sinus rhythm with an additional 5 mg dose of verapamil. Of the remaining 8 patients not converted with verapamil, 4 converted with 6 mg of adenosine and 3 patients were converted with 18 mg of adenosine and one patient needed direct cardioversion.[35] Also Lim S.H. et al conducted a randomized controlled trial in 2009 where 206 patients with SVT have been enrolled, of these 102 received calcium channel blocker (verapamil=48 / diltiazem =54), and 104 patients treated with adenosine, of these 14 patients not converted by 6 mg and 12 mg of adenosine ,9 of them were successfully converted with verapamil infusion and 5 with diltiazem infusion.[25]

- The difference observed among above mentioned studies might have related to the statistical factors, in the form of sample size and study design, also may related to the severity of the disease, correct dose and method of administration of the antiarrhythmic agent.
- For institutions were both adenosine and verapamil are available for the treatment of PSVT, the choice

between the agents should be made on a case by case basis with awareness of contraindications and the adverse effect profile. including minor adverse effect regarding adenosine such as dizziness, flushing, bronchospasm, and hypotension in verapamil.

**Limitations of the study**

The sample size was comparatively smaller than other studies due to the confluence of the emergency department by COVID -19 cases during the study period.

## CONCLUSION AND RECOMMENDATIONS

**Conclusion**

1. Adenosine was superior to verapamil in the management of paroxysmal supraventricular tachycardia as it has rapid onset of action.
2. Verapamil still good option for the treatment of PSVT where adenosine is not available.

**Recommendations**

- Instruct about following the consecutive steps in emergency department during management of PSVT by starting with non-pharmacological trial either using carotid massage or Valsalva's manoeuver as these methods are found to be effective in terminating the attack thus may decrease the need for medications and hence decrease the burden on the health center.
- Follow a proper way of administration of Adenosine by intravenous injection, using as proximal as possible venous line followed by rapid saline flush .and if peripheral vein is used then a large bore cannula is required.

**Acknowledgments**

In the name of **Allah**, the most gracious and the most merciful, I would like to express my great appreciation to my supervisor (**Prof. Abbas Naji Al Sharifi**) for his support and valuable instruction throughout the course of the study.

I would also like to thank all the study participants including the patients and the residents in the Emergency Department of Al-Yarmouk Teaching Hospital for their cooperation to complete this research.

## REFERENCES

1. Kotadia ID, Williams SE, O'Neill M. Supraventricular tachycardia: An overview of diagnosis and management. Clinical Medicine (London), 2020; 20(1): 43-47.
2. Bibas L, Levi M, Essebag V. Diagnosis and management of supraventricular tachycardias. CMAJ, 2016; 6, 188(17-18): E466-E473.
3. Paroxysmal Supraventricular Tachycardia (PSVT). 2021 [cited 10 August 2021]. Available from: https://www.hopkinsmedicine.org/health/conditions-and-diseases/paroxysmal-supraventricular-tachycardia
4. Chauhan VS, Krahn AD, Klein GJ, Skanes AC, Yee R. Supraventricular tachycardia. Med Clin North Am, 2001; 85(2): 193-223, ix.
5. Hafeez Y, Quintanilla Rodriguez BS, Ahmed I, et al. Paroxysmal Supraventricular Tachycardia. In: Stat-Pearls. Treasure Island (FL): Stat-Pearls Publishing; 2021 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK507699/
6. Page RL, Joglar JA, Caldwell MA, Calkins H, Conti JB, Deal BJ, et al. 2015 ACC/AHA/HRS guideline for the management of adult patients with supraventricular tachycardia: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines and the Heart Rhythm Society. Journal of the American College of Cardiology, 2016; 67(13): e27-e115.
7. Brugada J, Katritsis DG, Arbelo E, Arribas F, Bax JJ, Blomstrom-Lundqvist C, et al. 2019 ESC Guidelines for themanagement of patients with supraventricular tachycardia. European heart journal, 2020; 41(5): 655-720.
8. Katritsis DG, Josephson ME. Differential diagnosis of regular, narrow-QRS tachycardias. Heart Rhythm, 2015; 1, 12(7): 1667-76.
9. Supraventricular tachycardia - Symptoms and causes. Mayo Clinic. 2021 [cited 11 August 2021]. Available from: https://www.mayoclinic.org/diseases-conditions/supraventricular-tachycardia/symptoms-causes/syc-20355243
10. Supraventricular Tachycardia: What Is It? WebMD. 2021 [cited 11 August 2021]. Available from: https://www.webmd.com/heart-disease/atrial-fibrillation/what-is-supraventricular-tachycardia
11. Whinnett ZI, Sohaib SA, Davies DW. Diagnosis and management of supraventricular tachycardia. Bmj, 2012; 11: 345.
12. Paroxysmal Supraventricular Tachycardia: Background, Etiology, Epidemiology. Emedicine.medscape.com. 2021 [cited 10 August 2021]. Available from: https://emedicine.medscape.com/article/156670-overview#a5
13. Al-Zaiti SS, Magdic KS. Paroxysmal Supraventricular Tachycardia: Pathophysiology, Diagnosis, and Management. Critical care nursing clinics of North America, 2016; 7, 28(3): 309-16.
14. Hadid C. Sustained ventricular tachycardia in structural heart disease. Cardiology Journal, 2015; 22(1): 12-24.
15. Jameson JL, Kasper DL, Longo DL, Fauci AS, Hauser SL, Loscalzo J, editors. Harrison's principles of internal medicine. New York: McGraw-hill education, 2018.
16. Appelboam A, Reuben A, Mann C, Gagg J, Ewings P, Barton A, et al. Postural modification to the standard Valsalva maneuver for emergency treatment of supraventricular tachycardias (REVERT): a randomized controlled trial. The

Lancet, 2015; 31, 386(10005): 1747-53.
17. Boriani G, Katritsis DG, Cosio FG, Hindricks G, Jais P, Josephson ME, et al. European Heart Rhythm Association (EHRA) consensus document on the management of supraventricular arrhythmias, endorsed by Heart Rhythm Society (HRS), Asia-Pacific Heart Rhythm Society (APHRS), and Sociedad Latinoamericana de Estimulación Cardiaca y Elect. Eur Heart J, 2018; 39: 1442– 5.
18. Lee KW, Badhwar N, Scheinman MM. Supraventricular tachycardia—part I. Current problems in cardiology, 2008; 1, 33(9): 467-546.
19. Verapamil Monograph for Professionals - Drugs.com. Drugs.com. 2021 [cited 14 August 2021]. Available from: https://www.d
20. Shaker H, Jahanian F, Fathi M, Zare M. Oral verapamil in paroxysmal supraventricular tachycardia recurrence control: a randomized clinical trial. Therapeutic advances in cardiovascular disease, 2015; 9(1): 4-9.
21. CALAN® verapamil hydrochloride tablets [Internet]. Dailymed.nlm.nih.gov. 2021 [cited 14 August 2021]. Available from: https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=55d5f933-42ff- 4c80-a102-0ccb7f76b082
22. Rehorn M, Sacks NC, Emden MR, Healey B, Preib MT, Cyr PL, et al. Prevalence and incidence of patients with paroxysmal supraventricular tachycardia in the United States. Journal of cardiovascular electrophysiology, 2021; 32(8): 2199-206.
23. Smith GD, Fry MM, Taylor D, Morgans A, Cantwell K. Effectiveness of the Valsalva Manoeuvre for reversion of supraventricular tachycardia. Cochrane database of systematic reviews, 2015(2).
24. Ballo P, Bernabo D, Faraguti SA. Heart rate is a predictor of success in the treatment of adults with symptomatic paroxysmal supraventricular tachycardia. European heart journal, 2004; 1, 25(15): 1310-7.
25. Lim SH, Anantharaman V, Teo WS, Chan YH. Slow infusion of calcium channel blockers compared with intravenous adenosine in the emergency treatment of supraventricular tachycardia. Resuscitation, 2009; 1, 80(5): 523-8.
26. Dogan H, Ozucelik DN, Aciksari K, Caglar IM, Okutan N, Yazicioglu M, et al. To decide medical therapy according to ECG criteria in patients with supraventricular tachycardia in emergency department: adenosine or diltiazem. International journal of clinical and experimental medicine, 2015; 8(6): 9692.
27. Brubaker S, Long B, Koyfman A. Alternative treatment options for atrioventricular-nodal-reentry tachycardia: an emergency medicine review. The Journal of emergency medicine, 2018; 1, 54(2): 198-206.
28. Alabed S, Sabouni A, Providencia R, Atallah E, Qintar M, Chico TJ. Adenosine versus intravenous calcium channel antagonists for supraventricular tachycardia. Cochrane Database of Systematic Reviews, 2017(10).
29. World Health Organization. Body Mass Index, 2019 www.euro.who.int/en/health-topics/disease-prevention/nutrition/a-healthy- lifestyle/body-mass-index-bmi
30. Shimizu Y, Sato S, Koyamatsu J, Yamanashi H, Higashi M, Nagayoshi M, et al. Serum sodium level within the normal range is associated with maximum voluntary tongue pressure against the palate among community-dwelling older Japanese men. Geriatr Gerontol Int, 2018; 18(1): 183-186.
31. Gill BU, Bukhari SN, Rashid MA, Saleemi MS, Zaffar MZ. Comparing the efficacy of intravenous adenosine and verapamil in termination of acute paroxysmal supra ventricular tachycardia. Journal of Ayub Medical College, Abbottabad: JAMC, 2014; 26(1): 29-31.
32. Athar M, Majid A, Hussain A, Haider I, Shahid N, Ahmed I. Comparison of efficacy of intravenous adenosine and verapamil in acute paroxysmal supraventricular tachycardia in adults. Journal of Sheikh Zayed Medical College (JSZMC), 2013; 4(3): 492-6.
33. Porter MJ, Morton JB, Denman R, Lin AC, Tierney S, Santucci PA, et al. Influence of age and gender on the mechanism of supraventricular tachycardia. Heart Rhythm, 2004; 1(4): 393-6.
34. Cheng KA. [A randomized, multicenter trial to compare the safety and efficacy of adenosine versus verapamil for termination of paroxysmal supraventricular tachycardia]. Zhonghua nei ke za zhi, 2003; 42(11): 773-6.
35. Riaz R, Mishra J, Hussain S, Sinha L. Adenosine versus verapamil for the treatment of supra-ventricular tachycardia: randomized comparative trial. Pakistan Journal of Medical and Health Sciences, 2012; 6(3): 541-3.