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A CROSS-SECTIONAL STUDY TO ASSESS THE EFFICACY OF VALVSALVA MANEUVER FOR THE EMERGENCY MANAGEMENT OF SUPRAVENTRICULAR TACHYCARDIA

Original Research

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ABSTRACT

Background: Supraventricular tachycardia (SVT) is a common arrhythmia presenting in emergency settings and is characterized by rapid atrial activity leading to palpitations, chest pain, and hemodynamic compromise. Restoring sinus rhythm is a primary goal in acute management and can be achieved through pharmacological agents, electrical cardioversion, or vagal maneuvers. Among these, the Valsalva maneuver (VM) is a non-invasive, low-cost, and widely used technique. Despite its established use globally, limited data exist regarding its efficacy in local emergency care contexts, warranting further evaluation.

Objective: To determine the efficacy of the Valsalva maneuver in the emergency management of supraventricular tachycardia.

Methods: This cross-sectional study was conducted in the Department of Emergency Medicine, CMH Rawalpindi, from 15th April 2022 to 14th April 2024. A total of 192 patients aged 20–70 years, both male and female, with SVT confirmed on ECG were enrolled using non-probability consecutive sampling. Patients with myocardial infarction, aortic stenosis, pregnancy, retinopathy, raised intraocular pressure, or severe cardiopulmonary compromise were excluded. Standard and modified forms of the VM were performed under continuous ECG and vital monitoring. Efficacy was defined as reversion to sinus rhythm with a heart rate <110 beats per minute within one minute of the maneuver. Data were analyzed using SPSS version 24, applying chi-square and t-tests with $p \leq 0.05$ considered significant.

Results: The mean age of patients was 48.52 ± 10.70 years in the standard group (n = 124) and 50.15 ± 9.69 years in the modified group (n = 68). Males comprised 51.6% of the standard group and 72.1% of the modified group. Overall efficacy of VM was 32.3% (n = 62). Standard VM was effective in 38.7% (n = 48) compared with 20.6% (n = 14) in the modified group (p = 0.010). Mean stay in the emergency room was 3.16 ± 1.84 days versus 3.07 ± 1.42 days in the two groups (p = 0.733).

Conclusion: The Valsalva maneuver was effective in terminating SVT and restoring sinus rhythm. Its simplicity, safety, and cost-effectiveness make it a valuable first-line intervention in emergency settings, particularly in resource-limited environments.

Keywords: Electrocardiography, Emergency Service Hospital, Supraventricular Tachycardia, Treatment Outcome, Vagal Maneuvers, Valsalva Maneuver, Ventricular Function.

INTRODUCTION

Supraventricular tachycardia (SVT) represents a diverse group of arrhythmic disorders originating above the level of the ventricles and is a frequently encountered condition in both adult and pediatric populations (1). Its annual incidence is estimated at 0.35 per 1000 individuals, underscoring its clinical significance (2). Electrocardiographically, SVT often presents as a narrow QRS complex tachycardia, which may be regular or irregular. Regular types include sinus tachycardia, atrial tachycardia, atrioventricular nodal reentrant tachycardia, and atrioventricular reentrant tachyarrhythmias, whereas irregular forms comprise atrial fibrillation, atrial flutter, and multifocal atrial tachycardia. The clinical burden of atrial fibrillation alone has been highlighted in local populations, where its frequency among ischemic stroke patients underscores the significance of supraventricular arrhythmias in systemic disease (3). The clinical presentation of SVT is variable, ranging from benign palpitations to more distressing symptoms such as chest pain, shortness of breath, hypotension, sweating, or confusion, all of which may significantly affect patient well-being (4). Diagnosis is primarily established through careful evaluation of clinical history and characteristic ECG findings. Over time, several therapeutic modalities have been developed, including pharmacological agents, electrical cardioversion, and non-pharmacological clinical maneuvers. Among these, vagal maneuvers have gained wide acceptance for their simplicity and immediate applicability in emergency settings (5,6).

The Valsalva maneuver (VM) remains the most frequently recommended first-line clinical intervention in the acute management of SVT, with reported success rates of approximately 20% in restoring sinus rhythm (7). Its mechanism is linked to increased intrathoracic pressure, transient reduction in venous return, and enhanced vagal stimulation, which together promote slowed conduction through the atrioventricular node and termination of tachyarrhythmias (8,9). Traditionally performed in the supine position, the technique has been adapted into modified forms such as sitting and semi-recumbent postures to potentially improve outcomes (10). Despite its established role, controversy persists regarding the most effective technique, duration, and timing of VM in emergency settings (11). Given the growing emphasis on non-invasive and resource-efficient interventions, further clarity on the efficacy of VM in acute SVT management is essential. In particular, evaluating its success rate, time to restoration of sinus rhythm, and associated safety profile can provide valuable insights for refining emergency protocols. Therefore, this study was conducted to assess the effectiveness of the Valsalva maneuver in the acute management of SVT, with the objective of determining its clinical utility and role in reducing reliance on pharmacological or invasive therapies.

METHODS

This cross-sectional study was conducted in the Department of Emergency Medicine at CMH, Rawalpindi, over a two-year period from 15th April 2022 to 14th April 2024. Male and female patients aged between 20 and 70 years who were diagnosed with supraventricular tachycardia (SVT) on electrocardiography (ECG) were eligible for inclusion. Patients were excluded if they were pregnant, had a diagnosis of myocardial infarction or aortic stenosis, a history of raised intraocular pressure or retinopathy, or were severely cardiopulmonary compromised. The diagnosis of SVT was established on ECG findings showing a heart rate greater than 150 beats per minute, unrecognizable or abnormal P waves, and a QRS complex duration of less than 0.12 seconds. Efficacy was defined as the restoration of normal sinus rhythm, characterized by recognizable P waves and a heart rate of less than 110 beats per minute, recorded one minute after the maneuver. The required sample size was calculated to be 192 using the World Health Organization (WHO) sample size calculator. The calculation was based on an anticipated efficacy of the Valsalva maneuver in SVT at 42.7%, with a margin of error of 7% and a 95% confidence level (1). Participants were recruited using a non-probability consecutive sampling technique. Ethical approval for the study was obtained from the Institutional Review Board (IRB) of College of Physicians and Surgeons Pakistan (CPSP), and informed written consent was taken from all participants prior to enrolment.

At baseline, demographic and clinical data were recorded, and all patients were continuously monitored using vital signs assessment and ECG monitoring. The standard Valsalva maneuver was performed with the aid of a syringe. The plunger was first positioned at one-quarter capacity, and patients were instructed to blow forcefully into the syringe in an attempt to move the plunger. The technique was repeated with the plunger at the zero mark to generate an intrathoracic pressure of approximately 40 mmHg for a duration of 15 seconds, after which the patient remained in the same supine position for an additional 45 seconds under continuous cardiac monitoring. For the

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INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

modified Valsalva maneuver, the same procedure was followed; however, after the forced expiration, the patient's legs were elevated to a 45-degree angle for 15 seconds. ECG tracings were recorded one minute after the maneuver, and efficacy was determined as per the operational definition, documenting successful reversion to sinus rhythm. Data were entered and analyzed using the Statistical Package for Social Sciences (SPSS), version 24. Descriptive statistics were applied to summarize the data, with frequencies and percentages presented for categorical variables and mean ± standard deviation calculated for continuous variables. Inferential statistics included chi-square tests and Fisher's exact test for categorical comparisons, while Student's t-test was used for continuous data. A p-value ≤0.05 was considered statistically significant.

RESULTS

The mean age of participants was 48.52 ± 10.70 years in the standard Valsalva group and 50.15 ± 9.69 years in the modified group. The majority of patients were aged more than 45 years, comprising 63.7% in the standard group and 57.4% in the modified group. Male participants accounted for 51.6% in the standard group compared with 72.1% in the modified group, showing a significant difference in gender distribution (p = 0.006). The mean body mass index (BMI) was 24.38 ± 2.39 kg/m² in the standard group and 24.97 ± 2.08 kg/m² in the modified group, with a higher proportion of patients having BMI greater than 24.0 kg/m² in the modified group (73.5% vs. 56.5%, p = 0.019). Hypertension was the most prevalent comorbidity, reported in 35.5% of patients in the standard group and 17.6% in the modified group. Diabetes mellitus was observed in 17.7% and 10.3%, respectively. Valvular heart disease was present in 3.2% of the standard group versus 14.7% of the modified group. Asthma or COPD was reported in 16.1% of the standard group, while none were observed in the modified group. Pulmonary tuberculosis was more frequent in the modified group (16.2%) compared with the standard group (3.2%). A higher proportion of patients in the modified group had no comorbidities compared with the standard group (41.2% vs. 24.2%). Regular type SVT was found in 52.4% of the standard group and 54.4% of the modified group, while irregular type accounted for 47.6% and 45.6%, respectively. The overall efficacy of the Valsalva maneuver in terminating SVT was 32.3% (n = 62). The success rate was significantly higher in the standard maneuver group at 38.7% (n = 48) compared with 20.6% (n = 14) in the modified group (p = 0.010). The mean duration of stay in the emergency room was similar between the two groups, recorded as 3.16 ± 1.84 days in the standard group and 3.07 ± 1.42 days in the modified group, with no significant difference (p = 0.733). Rescue therapy was required in 59.9% (n = 115) of the total study population. A significantly greater proportion of patients in the standard group required rescue therapy (68.5%) compared with those in the modified group (44.1%, p = 0.001).

Table 1: Means ± S.D of Patients According to Age, BMI And Stay in ER (n = 192)

Valsalva maneuver type	Parameters	Mean	Std. Deviation
Standard (n = 124)	Age (years)	48.52	10.703
	BMI (kg/m^2)	24.383	2.3899
	Stay in ER (days)	3.16	1.836
Modified (n = 64)	Age (years)	50.15	9.687
	BMI (kg/m^2)	24.968	2.0800
	Stay in ER (days)	3.07	1.418

Table 2: Frequencies and Percentages of Patients According Baseline Clinic-Demographic Parameters (n = 192)

Parameters	**Subgroups**	**Valsalva Type**		**P value**
		Standard (n = 124)	**Modified (n = 64)**	
Age (years)	45 or below	45	29	0.387
		36.3%	42.6%	
	More than 45	79	39	
		63.7%	57.4%	
Gender	Male	64	49	0.006
		51.6%	72.1%	
	Female	60	19	
		48.4%	27.9%	

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Parameters	Subgroups	Valsalva Type		P value
		Standard (n = 124)	Modified (n = 64)	
BMI (kg/m^2)	24.0 or below	54	18	0.019
		43.5%	26.5%	
	More than 24.0	70	50	
		56.5%	73.5%	
Education	None	61	33	0.051
		49.2%	48.5%	
	Primary	39	28	
		31.5%	41.2%	
	Secondary	12	7	
		9.7%	10.3%	
	Tertiary	12	0	
		9.7%	0.0%	
Smoking	No	73	31	0.077
		58.9%	45.6%	
	Yes	51	37	
		41.1%	54.4%	
Comorbidities	Hypertension	44	12	0.000
		35.5%	17.6%	
	Diabetes	22	7	
		17.7%	10.3%	
	Valvular heart disease	4	10	
		3.2%	14.7%	
	Asthma/COPD	20	0	
		16.1%	0.0%	
	Pulmonary Tb	4	11	
		3.2%	16.2%	
	None	30	28	
		24.2%	41.2%	
SVT type	Regular	65	37	0.791
		52.4%	54.4%	
	Irregular	59	31	
		47.6%	45.6%	

Table 3: Comparison of Standard and Modified Valsalva for Efficacy (n = 192)

		Valsalva Type		Total	P value
		Standard (n=124)	Modified (n =68)		
Efficacy	Yes	48	14	62	0.010
		38.7%	20.6%	32.3%	
	No	76	54	130	
		61.3%	79.4%	67.7%	

Table 4: Comparison of Standard and Modified Valsalva for During of Stay in ER (n = 192)

	Valsalva Type	N	Mean	S. D	Std. Error Mean	P value
Stay in ER (days)	Standard	124	3.16	1.836	.165	0.733
	Modified	68	3.07	1.418	.172	

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Table 5: Comparison of Standard and Modified Valsalva for Rescue Therapy (n = 192)

		Valsalva Type		Total	P value
		Standard (n=124)	Modified (n=68)		
Rescue therapy	Yes	85	30	115	0.001
		68.5%	44.1%	59.9%	
	No	39	38	77	
		31.5%	55.9%	40.1%	
Total		124	68	192	
		100.0%	100.0%	100.0%	

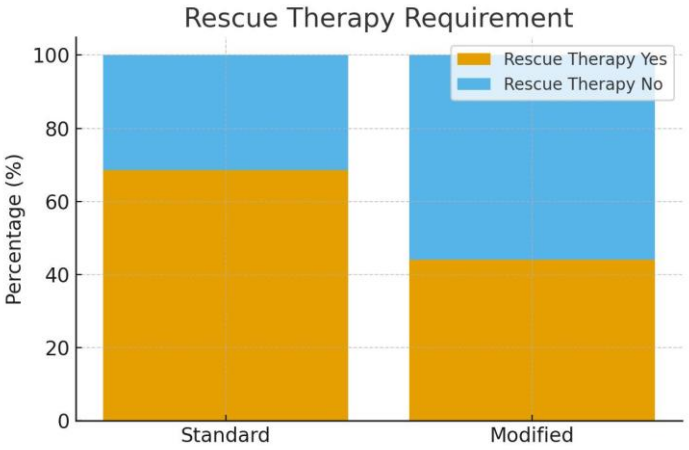

Figure 2 Rescue Therapy Requirement

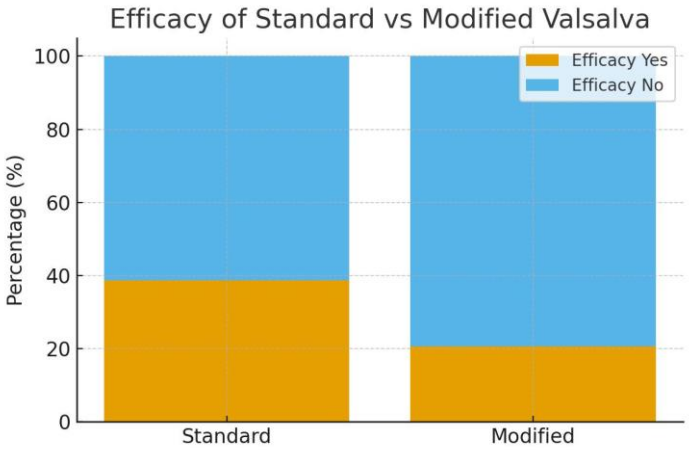

Figure 2 Efficacy of Standard vs Modified Valsalva

DISCUSSION

The present study demonstrated that the Valsalva maneuver is a simple, rapid, and effective tool for the reversion of supraventricular tachycardia (SVT) into sinus rhythm. The overall efficacy observed was 32.3%, with the standard technique achieving a higher success rate (38.6%) compared with the modified technique (20.6%). These findings highlight the clinical value of the maneuver in emergency settings, particularly where pharmacological or invasive approaches are less feasible. When compared with prior local studies, the efficacy reported in this study is somewhat higher than success rates of approximately 23% to 27% documented in similar populations (12,13). The variation in outcomes may be attributable to differences in patient compliance, technique execution, and operator familiarity with the maneuver. In contrast, evidence from other regional research has reported that the modified Valsalva maneuver achieved better efficacy, reduced complications, shortened emergency room stays, and minimized the requirement for anti-arrhythmic medications (14,15). In the present study, however, the modified technique was not superior to the standard approach, a finding that contrasts with the majority of international data, where the modified maneuver consistently demonstrated greater effectiveness in terminating SVT episodes (16,17). Further comparison with interventional modalities reveals that radiofrequency ablation has been shown to achieve high success rates in definitive management of SVT, independent of arrhythmia origin (13-15). Nonetheless, this option requires advanced infrastructure and specialized expertise, making it less accessible in resource-limited settings. In such contexts, the Valsalva maneuver retains its importance as a first-line, non-invasive, cost-effective, and immediately deployable intervention. The results also indicated no significant difference in the duration of emergency room stay between the standard and modified techniques. Similar observations have been reported in other studies where hospitalization duration did not differ substantially between the two methods (18,19). Evidence from experimental work employing varying intrathoracic pressures and timeframes confirmed that vagal responses were not significantly influenced by patient weight, sex, or age, further underscoring the maneuver's general applicability (20). However, positioning strategies, such as employing the Trendelenburg position, have been reported to enhance termination rates, suggesting that technique optimization may hold promise for improving outcomes (21).

INSIGHTS-JHR
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The strengths of the present study include a relatively large sample size, standardized definitions for efficacy, and rigorous statistical analysis. Continuous monitoring ensured accurate recording of rhythm changes and enhanced the reliability of outcomes. However, certain limitations must be acknowledged. The study did not assess the time to restoration of sinus rhythm, which is a critical indicator of maneuver effectiveness. Furthermore, no adverse events or complications such as hypotension, syncope, or patient intolerance were documented, limiting the ability to comment on safety profiles comprehensively. The reliance on a single-center design may restrict generalizability, and the use of non-probability consecutive sampling may have introduced selection bias. Future research should focus on standardizing the technique with objective pressure measurements using manometry, ensuring patient compliance, and systematically recording adverse events. Comparative trials between different postures, pressures, and durations would clarify optimal protocols. Multicenter randomized studies with larger populations would also enhance external validity and provide more robust evidence to inform clinical guidelines. In summary, this study reinforces the utility of the Valsalva maneuver as a readily available and life-saving intervention for SVT, particularly in low-resource environments. Although the standard technique demonstrated higher efficacy than the modified form in this cohort, global evidence suggests potential benefits of modified approaches. Further refinement of the maneuver and well-designed comparative trials are essential to establish its most effective clinical application.

CONCLUSION

The study concluded that both conventional and modified forms of the Valsalva maneuver are effective strategies for terminating supraventricular tachycardia, offering a safe, rapid, and non-invasive option for emergency management. Its simplicity, cost-effectiveness, and absence of adverse effects make it an invaluable first-line intervention, particularly in resource-limited settings where advanced therapies may not be readily available. By reducing the need for pharmacological treatment or invasive procedures, the maneuver holds significant potential to improve patient outcomes and empower individuals to manage episodes in acute situations, reinforcing its role as an essential component of emergency cardiac care.

AUTHOR CONTRIBUTION

Author	Contribution
Muhammad Shehzad Ali Siddiqi	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Numan khan	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Muhammad Bilal*	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Faisal Muhammad	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Muhammad Zubair	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Emad khan	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published

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