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ORIGINAL ARTICLE

Carotid sinus massage: A reconsideration in supraventricular tachycardia

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ABSTRACT

Background: Supraventricular tachycardia (SVT) is attributable to the orthodromic re-entry phenomenon when tachycardia is secondary to normal anterograde electrical conduction.

Objective: To determine the clinical efficacy of carotid sinus massage in terminating the episode of supraventricular tachycardia and the incidence of adverse events associated with carotid sinus massage.

Methods: A Quasi experimental pretest post-test study was conducted in the Emergency Department of CMH Multan, Pakistan, after Institutional ethical approval (13/Trg, ERC no. 22/2024) from 20th March to 15th June 2024. This study involved 200 patients, above 25 years of age, presenting to the emergency department with palpitations. Standard 12 lead electrocardiogram was done to diagnose SVT. After informed consent was obtained, patients were placed supine with the neck slightly extended and turned to the opposite side. Carotid sinus massage (CSM) was done, and patients were retained in the emergency detention room. The efficacy of CSM was assessed by termination of SVT within 30 seconds of CSM and incidence of its adverse events was noted during or 1 hour after the CSM procedure.

Results: The mean age of study participants was 35.55±8.6 years and the majority were females (59.5%). The CSM was successful in terminating SVT in 18.5% of the patients. The frequency of adverse events of CSM was dizziness (3.5%), vomiting (2.5%), syncope (1.5%), and exacerbation of arrhythmia (3.5%), and temporary neurologic complications (1%). The success rate of CSM was higher in non-diabetic patients (p=0.020) and those reporting within 2 hours of the onset of the first episode of SVT (p=0.000).

Conclusion: Carotid sinus massage is an effective and safe intervention for early-on spot management of supraventricular tachycardia.

Key Words: Carotid sinus massage, Supraventricular tachycardia, Adverse events

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INTRODUCTION

Supraventricular tachycardia (SVT) is characterized by narrow complex of the tachyarrhythmia, typically originating from a focus point, at or above the atrioventricular (AV) node. The heart rate in SVT ranges from 140 to 250 beats per minute.[1] These arrhythmias globally affect approximately 2.25 per 1,000 persons in the general population, with an increasing incidence in the older population. There is also a clear female predominance in the incidence with a 2:1 ratio across all age groups.[2] Pakistan, the world's fifth most populous country with 242 million people, lacks comprehensive nationwide health statistics, including data on SVT incidence, a common issue in developing nations.[3]

SVT episodes can cause significant discomfort and anxiety in patients, leading to frequent emergency department visits and even hospitalization.[4] Patients who are hemodynamically stable, the vagal maneuvers are considered the initial therapeutic intervention for the SVT, aiming to decelerate or

potentially terminate the arrhythmia. In carotid sinus massage (CSM) light pressure is applied to the carotid sinus along the carotid artery for 5-10 seconds, thereby directly stimulating the carotid baroreceptor and increasing the parasympathetic activity and hence a decrease in heart rate, so breaking the re-entrant circuits.[5,6]

The effectiveness of CSM in terminating SVT depends upon certain factors like age, duration of episodes of SVT, underlying heart condition, and importantly proper technique for CSM. Despite its long-term use, the efficacy and safety of CSM in terminating SVT episodes is a subject of discussion in medical research.[3]

SVT remains a significant concern in Pakistan due to the lack of hands-on practice of carotid sinus massage and its inclusion in routine clinical practice, which hinders doctors' attitudes towards its use as first-line management. This study aimed to determine the effect of CSM in terminating episodes of SVT and to find out the frequency of adverse events associated with the use of carotid sinus massage

METHODS

It was a Quasi experimental pretest post-test study conducted in the Department of Emergency Medicine, CMH Multan, Pakistan, from 20th March to 15th June 2024. WHO sample size calculator was used to estimate the sample size of 128, by keeping a 95% confidence interval, a 5% margin of error, and a success rate of CSM 9.10%,[7] however, we recruited 200 patients.

A total of 200 patients, males and females, more than 25 years of age and presenting to the emergency department with palpitations and diagnosed as having SVT, were included using non-probability consecutive sampling. Patients with contraindications of CSM (previous history of carotid artery disease, stroke, transient ischemic attack, and myocardial infarction within the last 3 months, uncontrolled hemodynamics, and severe hypotension) and those taking medications that can affect heart rate were excluded from the study. The efficacy of CSM was taken as the success rate of SVT termination after 30 seconds of CSM i.e. the return to sinus rhythm of 60-100 beats per minute (bpm) within 30 seconds of CSM. Patients presenting with the palpitations and a suspicion of SVT underwent standard 12-lead ECG.

After confirmation of SVT, patients, and attendants were informed about SVT, CSM procedure, and possible adverse events of CSM. Informed consent was taken, and demographic data, history of comorbidities, i.e. hypertension, diabetes, anemia, or hyperthyroidism, and patient reporting time, previous history of SVT, heart rate, blood pressure, and oxygen saturation were recorded. The patient was positioned supine with the neck slightly extended and tilted to the right side, ECG electrodes were applied, and heart rate and rhythm monitoring was started. The left carotid artery, being closer to the heart, was palpated first. Gentle pressure was applied along the artery in an up-and-down motion for 5 to 10 seconds, followed by a 30-second wait to observe the return of the SVT to a normal heart rate of 60-100 bpm.[8] If the heart rate returned to normal then the procedure was stopped, if the heart rate didn't return to normal then CSM was done on the opposite side with a 1-minute interval and results were observed in terms of termination or presence of SVT. Post CSM, heart rate, blood pressure, and oxygen saturation were recorded.

Throughout the procedure and for up to five minutes afterward, heart rate and rhythm were continuously monitored through ECG to detect any recurrence of SVT after the CSM. The patients were retained in the emergency detention room for 1 hour after CSM for observation of any adverse events of CSM like dizziness, syncope, vomiting, exacerbation of arrhythmia, or temporary neurological symptoms (visual disturbances/paresthesia) and for the observation of recurrence of SVT (Figure 1).

Ethical Approval

This study was approved by the Ethical Review Board of CMH Multan, Pakistan (reference no: 25/2024), on March 10, 2024.

Statistical Analysis

Data was analyzed using SPSS version 25.0. Data was normally distributed as checked by the Shapiro-Wilk test. Quantitative variables were described as mean±SD and qualitative variables were expressed as frequencies and percentages. The association of the efficacy of CSM with the status of diabetes, previous history of SVT, gender, and reporting time was assessed by Chi-square. A p-value of <0.05 was considered statistically significant.

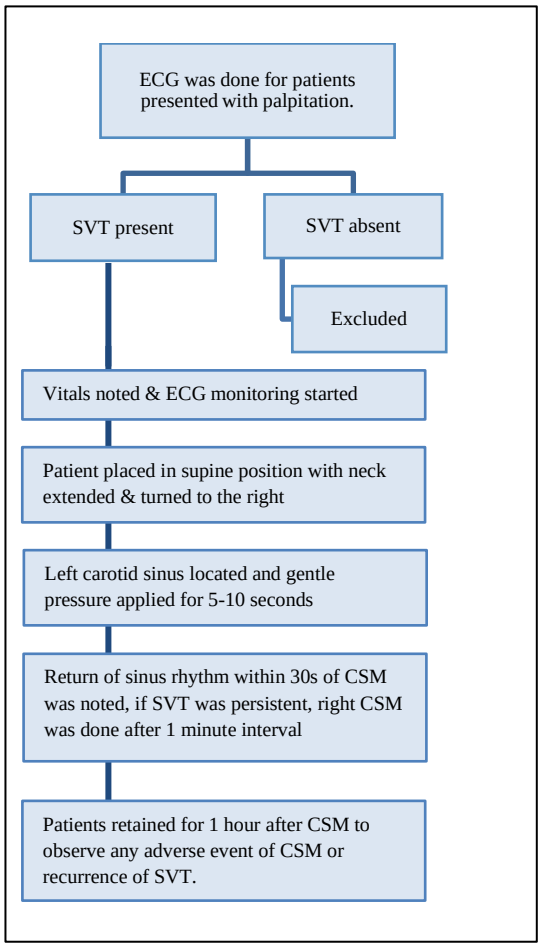

Figure 1: Flowchart showing the methodology of the study. ECG= Electrocardiogram, SVT= supra ventricular tachycardia, CSM= carotid sinus massage,

RESULTS

The study population was predominantly female. Most patients sought care more than two hours after the onset of SVT, with fewer presenting within two hours. Nearly half of the participants had a prior history of SVT. Hypertension was the most common comorbidity, followed by diabetes, anemia, and hyperthyroidism. These findings highlight the relevance of comorbid conditions in the management of SVT (Table 1).

The mean age of patients in this study was 35.55±8.6 years with an age range of 29-44 years. The blood pressure and oxygen saturation of all patients were in a normal range before and after CSM, but the pulse showed extreme tachycardia before CSM, however, the pulse became normal in patients with successful CSM (p value<0.05) (Table 2).

CSM was successful in terminating SVT (return of normal sinus rhythm) in 18.5% of patients within 30 seconds of CSM.

The frequency of adverse events during and after the CSM has shown that CSM was safe to be performed as first-line management of SVT (Table 3). There was a significant association of CSM success with the absence of diabetes (p=0.020) and with reporting time within 2 hours of developing SVT (p=0.000) **(**Table 4).

Table 1: Baseline qualitative characteristics of the study population

Variables	n (%)
Gender	
Male	81 (40.5)
Female	119 (59.5)
Reporting time	
Within 2 hours	78 (39)
After 2 hours	122 (61)
Past history of SVT	
Yes	86 (43)
No	114 (57)
Co-morbidities	
Hypertension	59 (29.5)
Diabetes	38 (19)
Anemia	27 (13.5)
Hyperthyroidism	9 (4.5)

SVT=supraventricular tachycardia,

Table 2: Baseline quantitative characteristics of the study population

Variables	Mean ± SD	p-value
Age (years)	35.55±8.6	
Systolic BP (mmHg)		
Before CSM	115.9±9.8	
After CSM	110±4.3	<0.05*
Diastolic BP (mmHg)		
Before CSM	78.42±5.5	
After CSM	71.5±5.3	<0.05*
Heart rate (Beats/min)		
In patients with successful CSM		
Before	171±15	
After	90±4	<0.05*
In patients with unsuccessful CSM		
Before	168±14	
After	150±12	<0.05*
SpO_2 (%)		
Before CSM	96.5±1.7	
After CSM	97.4±1.5	<0.05*
Temperature (°C)		
Before CSM	36.55±0.23	
After CSM	36.55±0.23	1.000

*Paired t-test was applied. *p-value of ≤ 0.05 is statistically significant. BP= blood pressure, CSM=carotid sinus massage, SpO_2=oxygen saturation*

Table 3: Frequency of successful CSM of SVT and adverse events of CSM in the study participants

Variable	n (%)
Successful CSM	
Yes	37 (18.5)
No	163 (81.5)
Adverse events of CSM	
No	176 (88)
Yes	24 (12)
Dizziness	7 (3.5)
Syncope	3 (1.5)
Vomiting	5 (2.5)
Exacerbation of arrhythmia	7 (3.5)
Temporary neurological complication	2 (1)

CSM=Carotid sinus massage, SVT=Supra ventricular tachycardia

Table 4: Association of efficacy of carotid sinus massage with status of diabetes, previous history of SVT, gender, and reporting time

Variable	CSM successful		χ^2/ p-value
	Yes	No	
Diabetes			
Yes	2	36	5.45/0.020*
No	35	127	
Past SVT history			
Yes	17	97	2.26/0.132
No	20	66	
Gender			
Male	14	67	0.13/0.715
Female	23	96	
Reporting time < 02 hours			
Yes	24	54	12.7/0.000*
No	13	109	

*Chi-square test was applied. *p value <0.05 is considered significant. SVT= Supra ventricular tachycardia, CSM= Carotid sinus massage.*

DISCUSSION

The present study included 200 patients with a mean age of 35.55 years and the majority were females. CSM was successful in terminating the episodes of SVT in 18.5% of patients, with a minor risk of adverse events that make it significant as first-line therapy of SVT management in the current setting. A higher success rate of CSM was observed in non-diabetic patients of SVT and in those presenting within 2 hours of developing SVT.

The higher incidence of SVT in females in the present study supports previous literature, showing a greater incidence in young to middle-aged females. These results can be due to the predominance with stress and anxiety which are the major risk factors for SVT.[1,8] In the current study, population has normal range of arterial blood pressure, oxygen saturation, tachycardia, and the comorbidities like diabetes and hypertension which are considered risk factors for SVT.[9]

The 18.5% efficacy of CSM in the current study was consistent with previous studies,[1,5] but another study has reported greater than 30% CSM efficacy in terminating SVT.[7,10] This difference may be due to the different study population demographics and different CSM technique positions. The current study adopted the supine position while previous studies with higher CSM efficacy adopted the Trendelenburg position.[7,10] In contrast, few studies did not show any significant success rate of CSM and as a first line treatment for acute episodes of SVT.[11,12]

A randomized control trial on the Valsalva maneuver has shown that when CSM was compared with the standard Valsalva maneuver and modified Valsalva maneuver, no significant difference in terms of efficacy was observed but adverse events of CSM were significantly less compared to other maneuvers.[13] A national study compared the effect of CSM and the Valsalva maneuver in terminating paroxysmal SVT, with a greater success rate of the Valsalva maneuver.[14] Another study reported 36% efficacy of CSM in terminating SVT compared to 60% efficacy of the Valsalva maneuver, but patients were not comfortable with the Valsalva maneuver, making CSM again superior to the Valsalva maneuver.[11] Another study presented CSM to be unsafe for narrow complex tachycardia as it lead to 1% incidence of cerebrovascular accident resulting in left hemiplagia,[15] but the present study did not report such incidents.

A meta-analysis revealed that there is no difference in the effect of the standard Valsalva maneuver and CSM in terminating SVT, however, the modified Valsalva maneuver was better among the three. Most adverse events like hypotension, nausea, dyspnea, and dizziness, were generally tolerable and spontaneously resolved upon termination of the maneuver.[16] A study on the overview of SVT management showed no significant difference in effects on SVT termination among different Valsalva maneuvers and CSM.[1]

The results of the present study are in line with the studies discussed above and validate the CSM as a moderately effective technique for eliminating SVT. Genetics, lifestyle, and healthcare access impact both actual and reported SVT incidences in Pakistan.[13] Arrhythmias, including SVT, atrial fibrillation, and

bradycardia, are ranked third among cardiovascular issues after coronary artery diseases and heart failure.[17] Limited training opportunities create significant workforce challenges, however, CSM being effective and safe may be kept as a possible first-line intervention for SVT while keeping in consideration the patients for whom the CSM is contraindicated.

CONCLUSION

Carotid sinus massage is a safe and well-tolerated intervention for managing the supraventricular tachycardia in patients who present within 2 hours, especially among non-diabetic individuals. With an efficacy of 18.5% and a 12% incidence of adverse events, Carotid sinus massage proves to be an effective treatment option with minimal side effects.

Limitations of the study

A limitation of this study is the small sample size, which was limited to emergency patients. Furthermore, indoor patients with heart diseases were not included in the study.

Future Recommendations

Different vagal maneuvers may add useful data in the management of SVT, using randomized trials.

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AUTHORS' CONTRIBUTION:

SF: Conception of the study, data acquisition, analysis, manuscript drafting, final approval of the published version

AN: Data collection, analysis & interpretation, critical review, final approval of the published version

HQA: Data collection, data analysis, manuscript drafting, final approval of the published version

All Authors agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

CONFLICT OF INTEREST:

All authors declared no conflict of interest.

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The data are available from the corresponding author upon reasonable request.

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