

Effectiveness of the Modified Valsalva Maneuver in the Emergency Management of Supraventricular Tachycardia

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Abstract

Background: The return rate of supraventricular tachycardia (SVT) to sinus rhythm by the standard Valsalva maneuver (SVM) is as low as 5%–20%. Despite the limited available data in the literature, the modified Valsalva maneuver (MVM) is promising. We tested the effectiveness of the MVM for the emergency treatment of patients with SVT. **Materials and Methods:** In this cohort prospective study, 93 confirmed SVT cases with mean age of 47.88 ± 15.66 years and female: male ratio (1.73) across multiple centers underwent MVM. The reversion to sinus rhythm after 1 min of the maneuver, in the first or second attempt, was considered to be a success, and other conditions were considered to be a failure. Alternative therapies were administered for nonresponders. **Results:** The overall success rate of the reversion of SVT to sinus rhythm by using MVM in this study is 47.3%. In addition, the rate was not affected by medical and drug histories, and the rate was not substantially different among the patients having different sociodemographics, blood pressures, and pulse rate statuses. MVM has a high cardioversion rate when used for patients with SVT. We recommend using it instead of the SVM as the first-line nonpharmacologic therapy for SVT. **Conclusion:** The MVM has a very reasonable cardioversion rate in the setting of emergency treatment of SVT regardless of the associated sociodemographic and medical histories of patients.

Keywords: Arrhythmias, cardioversion, modified Valsalva maneuver, supraventricular tachycardia, Valsava maneuver

INTRODUCTION

Supraventricular tachycardia (SVT) is a common tachyarrhythmia presented in emergency departments.^[1-4] The standard Valsalva maneuver (SVM) has been a safe nonpharmacologic therapy for patients with SVT, but with a low rate of cardioversion, in the range of 5%–20%. Thus, the nonresponders are usually managed by alternative therapies such as intravenous adenosine, which might cause unpleasant feelings related to transient asystole.^[5-10] Modifying an SVM by elevating the patient legs in a supine position following the strain, which is the modified Valsalva maneuver (MVM), might enhance the cardioversion rate in patients with SVT.^[11,12]

In this regard, few studies have focused on the effectiveness of MVM in the emergency management of SVT. For instance, Appelboom *et al.* reported that 43% of SVT patients who underwent MVM return to sinus rhythm successfully.^[10] The current study sought the cardioversion rate of patients with SVT undergoing MVM in Duhok, Iraq throughout 2017. In addition, the effectiveness of the maneuver was examined

with respect to age, sex, waist circumference (WC), and sociodemographic characteristics.

MATERIALS AND METHODS

Ninety-three patients with SVT, who presented to six emergency departments across Duhok district in Iraq between August and December 2017, were enrolled in this study.

An electrocardiogram (ECGs) for each patient was performed and recorded before and after the completion of the maneuver. Detailed information about the patients' medical and demographic history, including sex, age, systolic blood pressure (SBP)/diastolic blood pressure (DBP) in mmHg, WC in cm, and pulse rate (PR) in beats/min, was obtained. The SVT cases were classified as undiagnosed and previously

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diagnosed SVT. The cases were further subdivided into either SVT alone or SVT along with other medical diseases, namely hypertension, diabetes mellitus, and ischemic heart disease. The drug history focused on antiarrhythmic drugs (e.g., beta-blockers, calcium channel blockers, amiodarone, and digoxin).

The MVM was performed through a pressure of 40 mm Hg for 15 s by forced expiration of syringe. The patients performed the strain in a semirecumbent position and were laid flat with their legs raised to a 45° angle for 15 s at the end of the strain immediately before they were returned to the semirecumbent position.^[11,13,14] Participants were invited to attempt the maneuver a second time when the sinus rhythm was not restored.

The reverting to sinus rhythm, confirmed by an ECG after 1 min of intervention, was regarded as the primary outcome (success). If the sinus rhythm was achieved by the maneuver and using an alternative therapy, including adenosine (or other available treatments for SVT termination), it was considered to be a secondary (failure) outcome.

Patients were considered eligible for the study if they were 18 years of age or above, of either sex and presented to the hospital with SVT (regular, narrow complex tachycardia with QRS duration <0.12 s on the ECG). The patients who had atrial fibrillation/flutter, broad complex tachycardia, and hemodynamic instability or were unable to perform the maneuver were excluded from the study.

The ethical approval was obtained from the Kurdistan board of medical specialties, Kurdistan Region in Erbil, Iraq. A written consent form was obtained from all patients. The frequency and percentage of variables were performed for categorical and descriptive purposes. Mean and standard deviation was considered for the continuous characteristics of patients including, age, SBP, DBP, PR, and WC. The Chi-square test and independent *t*-test were performed accordingly. $P \leq 0.05$ was considered to be a significant difference.

RESULTS

The mean age of the patients was 47.88 ± 15.66 years. Approximately two-thirds of the patients were women (63.4%). The mean SBP and DBP were 119.18 ± 18.26 and 76.01 ± 12.09 , respectively. The mean PR was 177.50 ± 22.78 . More than 25% of the SVT patients were newly diagnosed. Of the cohort, 40.9% of the patients had a drug history that included anti-arrhythmic drugs [Table 1]. The outcomes of the first and second trials of the MVM are depicted in Table 2.

The study showed that 39 of 93 (41.9%) patients recovered following the first attempt of the maneuver. Of the remaining patients, 5 (9.3%) recovered following a second attempt, rendering the MVM as successful for almost half of the patients (47.3%) collectively. The remaining unrecovered patients (49%) underwent alternative therapies [Table 2].

Table 1: Baseline characteristics of supraventricular tachycardia patients

Patients' characteristics (n=93)	F (%)
Sex	
Male	34 (36.6)
Female	59 (63.4)
Past medical history	
SVT (alone and diagnosed)	35 (37.6)
SVT (diagnosed and other medical issues)	34 (36.6)
SVT (undiagnosed and other medical conditions)	6 (6.5)
SVT (alone and undiagnosed)	18 (19.4)
Past antiarrhythmic drug history	38 (40.9)
Age (year), mean±SD	47.88±15.66
SBP (mm Hg), mean±SD	119.18±18.26
DBP (mm Hg), mean±SD	76.01±12.09
PR (bpm), mean±SD	177.50±22.78
WC (cm), mean±SD	96.32±26.33

SVT: Supra ventricular tachycardia, SBP: Systolic blood pressure, DBP: Diastolic blood pressure, PR: Pulse rate, WC: Waist circumference, SD: Standard deviation

Table 2: Outcomes of the modified Valsalva maneuver in supraventricular tachycardia cases

Outcomes	F (%)
First trial	
Success	39 (41.9)
Failure	54 (58.1)
Second trial	
Success	5 (9.3)
Failure	49 (90.7)
Overall response	
Success	44 (47.3)
Failure	49 (52.7)
Alternative therapy	
Yes	49 (52.7)
No	44 (47.3)

The impact of general and medical characteristics of the cases on the cardioversion rate of the MVM was examined. Interestingly, the success rate of cardioversion by MVM was not significantly different among patients having newly diagnosed SVT compared with previously diagnosed SVT, having isolated SVT or SVT associated with other medical diseases ($P = 0.075$), or having a positive drug history or negative drug history ($P = 0.403$). Moreover, the cardioversion rate was not substantially different among patients with different sex ($P = 0.409$), age ($P = 0.077$), blood pressure ($P > 0.05$), PR ($P = 0.374$), and WC ($P = 0.271$) [Table 3].

DISCUSSION

The overall cardioversion rate of the MVM for the emergency treatment of SVT was 47.3% in our study in Iraq. Interestingly, the study did not show whether the past medical and drug histories, different sociodemographic status, means of blood pressure, and PRs of cases could affect the cardioversion either

Table 3: Relation of cardioversion outcome with patients' characteristics

Patients' characteristics	Outcome		
	Success (%)	Failure (%)	P
Sex			
Male	18 (52.29)	16 (47.1)	0.409*
Female	26 (44.1)	33 (55.9)	
Medical history			
SVT (alone and diagnosed)	16 (45.7)	19 (54.3)	0.075*
SVT (diagnosed and other medical issues)	17 (50.0)	17 (50.0)	
SVT (undiagnosed and other medical issues)	0 (0.0)	6 (100)	
SVT (alone and undiagnosed)	11 (61.2)	7 (38.9)	
Past antiarrhythmic drug history			
Yes	16 (42.1)	22 (57.9)	0.403*
No	28 (50.9)	27 (49.1)	
Age (year)	44.86±15.85	50.64±15.11	0.077**
WC (cm)	99.57±28.29	93.28±24.28	0.271**
SBP (mmHg)	119.81±15.58	118.58±19.05	0.753**
DBP (mmHg)	76.04±10.77	75.97±13.31	0.979**
PR (bpm)	179.79±24.46	175.48±21.24	0.374**

* χ^2 and **Independent *t*-tests were performed for statistical analyses. SVT: Supra ventricular tachycardia, SBP: Systolic blood pressure, DBP: Diastolic blood pressure, PR: Pulse rate, WC: Waist circumference

negatively or positively. The previous limited available data concerning this maneuver demonstrated a cardioversion rate comparable to the rate in this study. In their study, Smith found that, in comparing the modified and SVM, the success rate was 47% for the MVM and 17% in patients who underwent the SVM.^[14]

The most recent study, conducted by Appelboom *et al.* on patients suspected with SVT in six emergency departments in southwest England, showed a lower rate compared with the current study. The authors reported that 17% of the patients achieved sinus rhythm in SVM in comparison with the 43% in the experimental MVM group.^[10] We suspect that a lower rate in their study could be because of the involvement of many clinicians in the trial with a high heterogeneity bias in the delivery of procedure and maneuver performance.^[12] Walker and Cutting reported a rather lower rate, and only 31.6% of the cases achieved cardioversion by the MVM in a retrospective study.^[15] Interestingly, in this study, we found that all cases of SVT, whether newly diagnosed, on antiarrhythmic drugs, or associated with medical conditions, reasonably benefited from the maneuver. In our opinions, this point is highly important, especially when treating SVT with different characteristics using this maneuver especially in younger cases like ours. The significant adverse events were not recorded in the present study. However, some adverse events have been reported in other trials. Smith reported some adverse events during his study, such as hypotension, ECG changes, nausea, and musculoskeletal pain.^[14] Appelboom *et al.* did not report any serious adverse events as well.^[10] The MVM is a noninvasive and cost-effective technique for SVT patients presenting to the emergency department; however, it is essential to perform the technique of MVM correctly, as the success rate varies with different performance.^[6]

CONCLUSION

The MVM has a very reasonable cardioversion rate in the setting of emergency treatment of SVT regardless of the associated sociodemographic and past medical histories of patients. Furthermore, we recommend using this maneuver as the first-line nonpharmacological therapy for the termination of SVT attacks in our area.

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Conflicts of interest

There are no conflicts of interest.

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