

The frequency of reversion of paroxysmal supra-ventricular tachycardia with valsalva maneuver

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Abstract:

Background: Paroxysmal supra-ventricular tachycardia (PSVT) is a type of supra-ventricular tachycardia. PSVT is an episodic condition with an abrupt onset and termination. Studies show that Valsalva maneuver is the most potent physical maneuver to revert PSVT. Reversion rate of valsalva maneuver is satisfactory, but controversial evidences have been noticed in literature. This study was conducted to assess the frequency of reversion of paroxysmal supra-ventricular tachycardia with valsalva maneuver.

Study design: Descriptive case series

Setting: Emergency department, Punjab Institute of Cardiology

Duration: 4th August 2016 to 3rd February 2017

Material and Methods: One hundred patients admitted with supra-ventricular tachycardia were recruited and were given a trial of valsalva maneuver for a minimum duration of 15 seconds. Repeat ECG was done 1 minute after performing valsalva maneuver. If normal sinus rhythm was observed <100 beats/min assessed on ECG, then reversion of tachycardia was labeled. All the collected data was entered and analyzed on SPSS version 21.

Results: Total number of patients were 100, 74 % were male and 26% were female. The mean age of patients was 56.48 ± 15.57 years. The success rate of valsalva maneuver in reversion was noted in 23 (23%) patients. Statistically significant difference was observed between reversion of SVT and gender.

Conclusion: the success rate of valsalva maneuver in reversion of paroxysmal SVT was satisfactory and this method can be performed in emergency to revert SVT as it is easy and cost effective.

Keywords: Paroxysmal supra-ventricular tachycardia, Reversion, Valsalva Maneuver

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Introduction:

Paroxysmal Supra-ventricular tachycardia is very common in clinical practice and mostly presents in the emergency department. The SVT incidence in United States is approximately 35 cases per 100,000 patients with prevalence of 2.25 cases per 1,000.¹ Paroxysmal SVT is defined as an episode of abrupt tachycardia which originates above the ventricles and involves atrial tissue or atrioventricular (AV) nodal tissue. Usually they are transient and recurrent with a rapid termination.² There are three mechanisms of paroxysmal SVT i.e. increased automaticity, reentry and triggered activity.³ Patients with par-

oxysmal SVT present with tachycardia or palpitations, shortness of breath, chest pain, nausea, anxiety, dizziness or pre syncope or syncope due to reduced cardiac output.⁴ It is precipitated by stress, cardiac diseases, stimulants and electrolyte imbalance.⁵

Treatment options of paroxysmal SVT include vagal maneuvers, pharmacological therapy and synchronized direct current counter shock therapy.⁶ Vagal maneuvers are the first line treatment option in patients who are hemo-dynamically stable. These maneuvers increase the vagal tone and block the AV node. They include Valsalva

maneuvers, carotid sinus massage, immersion of the face in ice water and bearing down.⁷ Studies have shown that Valsalva maneuver is the most potent physical maneuver that reverts paroxysmal SVT due to significant vagal effect on AV node conduction.¹ VM increases the parasympathetic tone by increasing intrathoracic pressure for a brief period of time which leads to stimulation of the baroreceptors in the aortic arch and carotid bodies.² Currently, there are no guidelines regarding the number of attempts of VM before the initiation of other treatment modalities, although mostly two attempts are tried before other treatments.⁸

Pharmacologic therapy is used for acute episodes of paroxysmal SVT in patients when vagal maneuvers fail. Intravenous (IV) adenosine or a non-dihydro-pyridine calcium channel blocker is given. Verapamil (calcium channel blocker) blocks the propagation of action potential through the AV node that is calcium-channel dependent.¹ Adenosine causes transient asystole which gives very unpleasant and frightening feeling to the patient.⁹ Other side effects are hypotension, cardiac arrest and other ventricular dysrhythmias.¹⁰ Verapamil and diltiazem cause hypotension and bradycardia they are not used as first line treatment in the emergency setting. However, according to studies a single dose of verapamil can be used without any adverse effects.⁷ Due to these side effects of medications a less invasive approach warrants to be used to revert SVT. Reversion rate with valsalva maneuver is satisfactory. Approximately 25% success rate of valsalva maneuver in reversion of paroxysmal SVT has been reported, but there is wide variation in success rates among the studies ranging from 6% to 54%.¹¹

This study was conducted to confirm the effectiveness of Valsalva maneuver for reversion of paroxysmal SVT for future implementation in emergency settings as first line management so as to prevent the complications or hazardous consequences of paroxysmal SVT and side effects of pharmacological agents.

Material and Methods:

This descriptive case series was conducted in Emergency department, Punjab Institute of Cardiology Lahore, from 4th August 2016 to 3rd February 2017. 100 patients were enrolled in the study from the Emergency department of Punjab Institute of Cardiology (PIC), Lahore. The study was approved by hospital research and ethics committee and Informed consent were taken from attendants. Sample size of 100 cases were calculated with 95% confidence level and 7.5% margin of error and taking expected percentage of reversion of tachycardia of 17% with valsalva maneuver.⁹ Non-probability consecutive sampling technique was employed. All patients with ages between 30-80 years of either gender presenting with an acute episode of paroxysmal SVT, confirmed on ECG as a narrow complex junctional regular rhythm with a rate of >150 beats/min were included. Patients presenting with sinus tachycardia (on ECG), other types of SVT including atrial fibrillation, atrial flutter or aberrant conduction (on ECG) and broad complex tachycardia's (on ECG), haemodynamically unstable and required immediate cardio-version were excluded. Demographic data i.e. name, age, gender, body mass index (BMI), diabetes was also noted. Patients were given trial of valsalva² maneuver. They were asked to lie in supine position and instructed to inhale, hold their breath and bear down while tightening the chest and abdominal muscles for a minimum duration of 15 seconds. Patient's heart rate rhythm was continuously observed with a cardiac monitor. Repeat ECG was done 1 minute after performing valsalva maneuver. If normal sinus rhythm was observed <100 beats/min assessed on ECG, then reversion of tachycardia (presence of normal sinus rhythm with a cutoff point of <100 beats/min assessed on ECG 1 minute after Valsalva maneuver) was labeled. All data was recorded on proforma. Subsequent treatment of patients with unsuccessful valsalva maneuver depended on the treating clinicians according to protocol.

The data was analyzed using the statistical package of social sciences (SPSS) version 21. Quantitative variables like age, BMI were presented as

mean and standard deviation. Qualitative variables like gender, smoking, diabetes and reversion of tachycardia were presented as frequency and percentage. Data was stratified for age, gender, BMI and diabetes. Post-stratification, chi-square test was applied with $p\text{-value} \leq 0.05$ was taken as significant.

Results:

In this study, 100 cases were enrolled. The mean age of the patients was 56.48 ± 15.57 years, 74 (74%) patients were male and 26 (26%) patients were female male with male to female ratio of the patients were 2.84:1. The study results showed that the mean value of BMI of the patients was 25.13 ± 2.90 kg/m² with minimum and maximum BMI values of 20.20 & 30.30 kg/m² respectively. The reversion was noted in 23 patients (23%).

In this study, 56 patients were up to 60 years of age, in which reversion was noted in 15 patients. Similarly above 60 years patients were 44, in which reversion was noted in 8 cases. Statistically insignificant difference was found between the age with reversion i.e. $p\text{-value} = 0.310$. Male patients were 74 in which reversion was noted in 23 patients. Similarly female patients were 26 in which reversion was noted in none. Statistically significant difference was found between gender and reversion of SVT i.e. $p\text{-value} = 0.001$.

The study results showed that the patients with normal BMI were 48 in which reversion was noted in 14 patients. Similarly overweight and obese patients were 52 in which reversion was noted in 09 cases. Statistically insignificant difference was found between the BMI with reversion i.e. $p\text{-value} = 0.234$.

In our study, the diabetic patients were 55 in which reversion noted in 12 patients. Similarly patients without diabetes were 45 in which reversion noted in 11 cases. Statistically insignificant difference was found between the diabetes with reversion i.e. $p\text{-value} = 0.756$. All the findings are summarized in table-1;

Discussion:

Our study showed 23% success rate of valsalva maneuver in reversion of SVT. Mehta 12 and Wen 13 provided reversion success rates of 54.3% (19 out of 35) and 45.9% (61 out of 133), respectively, whilst the Lim 14 study reported reversion success of 19.4% (12 out of 62). Study conducted in England showed that with valsalva maneuver reversion of paroxysmal SVT was 17% only.¹⁵ Another study conducted in Sydney, showed that with valsalva maneuver reversion of paroxysmal SVT was 31.6%.¹⁶ Another study conducted in Australia assessing pre-hospital management of SVT effectiveness showed reversion rate of 27.7% with valsalva maneuver.¹⁷ These results are almost comparable with our study results. Cochrane review conducted in 2015 showed reversion rate of 45.9% and 54.3% within controlled laboratory environment and success rate of only 19.4% in clinical studies of SVT with valsalva maneuver. This huge difference may be due to methodological variations among the different studies.¹⁸

Studies were also conducted to compare the success rates of different valsalva maneuvers. A study by S Walker in which retrospective 6-months audit was done revealed only one successful reversion with Valsalva from a sample of 19 patients. 32 q1` doctors completed the questionnaire describing a variety of different valsalva techniques highlighting a lack of consensus. 27 patients were recruited to the prospective trial, of whom 19 were correctly diagnosed as having paroxysmal SVT. Of these 19 patients, 6 reverted with the modified Valsalva maneuver.¹¹ A randomized controlled trial showed that modified valsalva maneuver is better than standard valsalva maneuver in reverting SVT.¹⁹ All these studies have comparable success rates with our study. Also different methods of vulsalva maneuver need to be studied so that a standard protocol can be established for future management.

Increasing age has been related to decrease response to valsalva maneuver.¹² In our study, the mean age of patients who reverted was less than the age of those who did not respond, although it was statistically insignificant. This is compa-

rable with the findings of other researchers.^{16,20,21} This is probably due to the fact that aging is associated with attenuated response to autonomic system.¹²

In our study statistically significant difference was found between gender and reversion, i.e. p-value=0.001. Male patients were 74 in which reversion was noted in 23 patients. Similarly female patients were 26 in which reversion was noted in non. There are cardiac electro-physiological differences between men and women due to sex hormones. Testosterone shortens the QT interval whereas estrogen prolongs it. Progesterone has opposing effect to estrogen. It shortens the QT interval like testosterone. Due to increase in progesterone levels during the second half of normal menstrual cycle there is increased risk of SVT in women, especially AVNRT- the most common type of SVT in women is twice as common in women as in men.²² Another study conducted on gender and cardiac arrhythmias also concluded that there are sexual differences in the prevalence and incidence of cardiac arrhythmias for which no exact cause is known. Sex steroid hormones effect on ion channels and modulation of autonomic tone are the two suggested mechanisms.²³ The reason for failure of valsalva maneuver on reversion of SVT in women may be due to electrophysiological differences but we could not find any study on this. Studies conducted on different methods of valsalva maneuvers on reversion of SVT showed no difference with gender^{20,21} which is contradictory to our findings. This may be due to faulty technique but further research is required to find out the reasons as to why valsalva maneuver failed to work in women.

In our study, the diabetic patients were 55 in which reversion noted in 12 patients. Similarly patients without diabetes were 45 in which reversion noted in 11 cases. Statistically insignificant difference was found between the diabetes with reversion i.e. p-value=0.756. This finding is similar to the study conducted in Iran.²¹

The study results showed that the patients with normal BMI were 48 in which reversion was

noted in 14 patients. Similarly overweight and obese patients were 52 in which reversion was noted in 09 cases. Statistically insignificant difference was found between the BMI with reversion i.e. p-value=0.234. Although obesity is a risk factor for arrhythmias,²⁴ it has no effect on reversion. This is similar to the results shown in other studies.^{20,21}

We have shown moderately successful rate of reversion with standard valsalva maneuver and recommend its use in emergency departments as a routine first line treatment for SVT. It is simple procedure requiring few training hours in the department to learn so that it can be ensured that all providers perform the procedure in similar manner.

The limitation of our study is that it was not a randomized controlled trial for assessing the efficacy of valsalva maneuver in reversion of SVT. Also the standardization of technique could not be fully ensured due to change of emergency staff despite clear instructions.

Conclusion:

In our study, the success rate of Valsalva maneuver in reversion of paroxysmal SVT was found to be modestly effective. This maneuver should be employed in emergency to revert SVT as it is simple, cost effective, non invasive and easy to perform. As long as individuals can safely undertake it, this maneuver can be used as the routine initial treatment for SVT and can prevent many patients from being treated with drugs or even seeking health care.

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Dr Saqib Mailk, final review

Dr Iram Sarwar, article writing

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Dr. Mehreen Jadoon, data analysis

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