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The reverse vagal manoeuvre: A new tool for treatment of supraventricular tachycardia?

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ABSTRACT

Supraventricular tachycardia is a common cardiac arrhytmia with recurrent episodes. The rapid resolution of supraventricular tachycardia remains a challenge. Vagal manoeuvres are simple and non-invasive but yield positive results in less than half the cases. Currently, the modified Valsalva manoeuvre appears to be the most effective technique. We have tested the effectiveness of the reverse Valsalva manoeuvre without swallowing as new vagal manoeuvre for the treatment of supraventricular tachycardia. This new technique is easy to perform and can be carried out alone by the patient. We report in this series 11 cases of supraventricular tachycardia, 10 of which were effectively reduced after the completion of the reverse Valsava manoeuvre. The very encouraging results of this series of cases will have to be quickly evaluated by a randomised controlled trial. This new technique, which is simple to learn and carry out, could be easily taught throughout the world, including in regions with few health-care resources.

1. Introduction

Supraventricular tachycardia (SVT) is a frequent reason for recourse to emergency medicine. Often, patients experience recurrent episodes of SVT and have a history of this rhythm disorder. The rapid resolution of SVT remains a challenge. It can require the use of vagal manoeuvres or, in the event of failure, the administration of pharmacological agents and, more rarely, recourse to cardioversion [1]. Vagal manoeuvres are simple and non-invasive but yield positive results in only 40% of cases [2]. Carotid sinus massage (CSM), the standard Valsalva manoeuvre (sVM) and the modified Valsalva manoeuvre (mVM) are the three main techniques used to resolve SVT. To date, the mVM appears to be the most effective [3]. We have tested the effectiveness of a new vagal manoeuvre for the treatment of SVT (excluding flutter and atrial fibrillation). This is the reverse Valsalva manoeuvre (rVM) (or Toynbee manoeuvre) without swallowing. Here, we describe the reverse Valsalva manoeuvre and summarise the performance of this technique in 11 patients between February 2019 and May 2020.

2. Reverse Valsalva manoeuvre description

In the first step, the patient must be in a sitting position and exhale without force. The patient then attempts to inhale against resistance for 10 s, pinching their nose and closing their mouth tightly (Fig. 1). The resolution of SVT is accomplished within the next 10 to 15 s if effective. This manoeuvre is responsible for both an increase in vagal tone and a decrease in sympathetic activity responsible for bradycardia and arterial hypotension (the Bezold–Jarich reflex) [4], leading to SVT resolution.

3. Cases (See Table 1.)

3.1. Case 1

A 55-year-old patient, an emergency physician, with SVT as his only antecedent arrested his SVT by carrying out the rVM himself. In total, three of his last four SVT episodes (over a period of 2 years) were arrested by performing rVM. The rVM was carried out at the onset of SVT. Only one episode of SVT had to be treated by the intravenous

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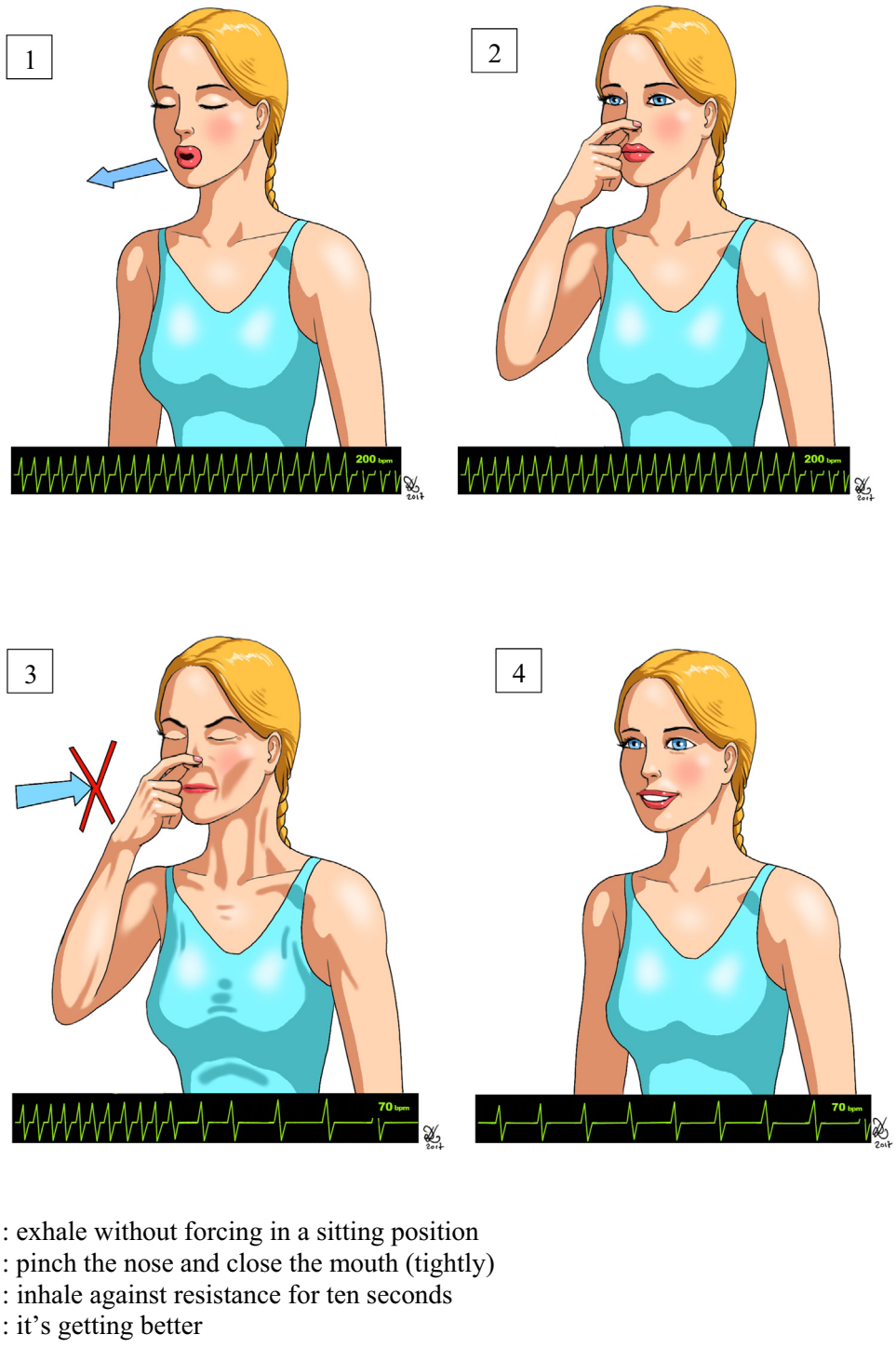

Fig. 1. Illustration of the reverse Valsalva Manoeuvre without swalling.

administration of calcium channel blockers after the failure of various vagal manoeuvres (mVM and rVM).

3.2. Case 2

An emergency medical system (EMS) staffed by physician responded to a 57-year-old patient who had been presenting with palpitations, dyspnoea and chest tightness for 1 h. The patient had no previous "SVT history" or treatment. The initial electrocardiogram (ECG) showed regular tachycardia with fine QRS at 210 bpm, suggesting SVT (Fig. 2). The emergency physician performed the classic vagal manoeuvres (sVM and mVM) but without effect. The patient then performed the rVM, which resulted in a return to a sinus rhythm (Fig. 3).

3.3. Case 3

A 51-year-old patient who underwent a heart transplant 5 years previously presented a first episode of palpitations. A physician-staffed

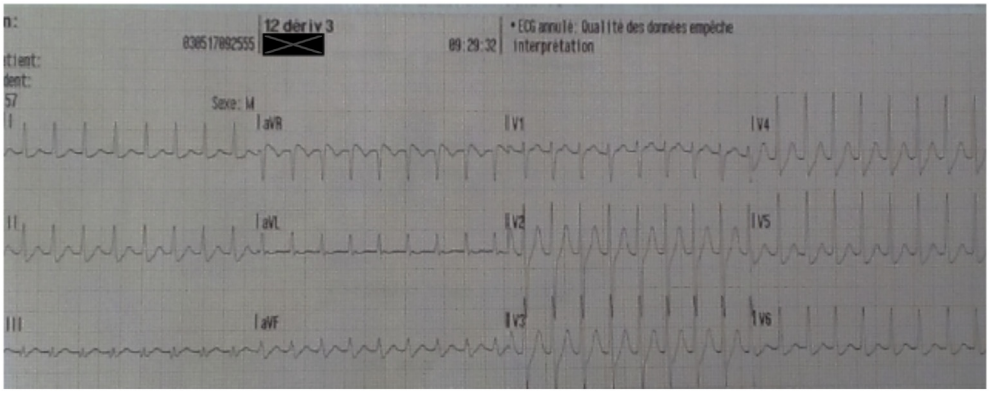

Fig. 2. Supraventricular tachycardia recorded at the arrival of the physician-staffed EMS in the case 2.

EMS was sent to his home and made the diagnosis of SVT. The various vagal manoeuvres (sVM, mVM and rVM) were not effective in arresting the tachycardia, nor was the administration of intravenous adenosine. The patient was then transported to a cardiac intensive care unit due to the history of heart transplantation. The tachycardia spontaneously resolved within a few hours (See Table 1.)

3.4. Cases 4 and 8

Two patients (70 and 48 years old) with a known history of SVT experienced new episodes of paroxysmal tachycardia, which were successfully arrested by the rVM after failure of the sVM and mVM. A medical dispatcher from the call processing centre guided the patients in conducting the various manoeuvres.

3.5. Case 5

A 32-year-old pregnant woman presented with SVT. A medical dispatcher from the call processing centre suggested that she carry out the rVM technique to treat the SVT. The physician-staffed EMS that was on-call noted a return in sinus rhythm on the ECG conducted at the patient's home.

3.6. Case 6

A 42-year-old patient with a known history of SVT called the ambulance service owing to a new episode of SVT. Knowing that vagal manoeuvres usually have no effect, the patient did not perform them before calling. The medical dispatcher suggested that the patient perform the mVM after it was explained over the phone. The resolution of SVT after performing the rVM allowed the patient to stay at home.

3.7. Case 7

A physician-staffed EMS called the processing centre before transferring a 50-year-old patient to the emergency department. The patient had a history of SVT and was experiencing a 180 bpm episode of SVT that did not resolve after performing the vagal manoeuvres (sVM and mVM) or after intravenous adenosine administration. The medical dispatcher suggested that the patient should perform the rVM before transfer to the emergency department. This proved to be effective and allowed the patient to remain at home.

3.8. Case 9

A 43-year-old patient with a history of SVT called the call processing centre due to a new attack of paroxysmal tachycardia in the context of acute otitis media. The patient refused to perform the sVM and mVM because of his otitis media. The medical dispatcher then suggested that the patient perform the rVM, which then resolved the SVT episode.

3.9. Case 10

A 27-year-old patient with hereditary chronic renal failure who underwent dialysis the day before presented with SVT at 225 bpm. The physician-staffed EMS sent to the patient's home helped him

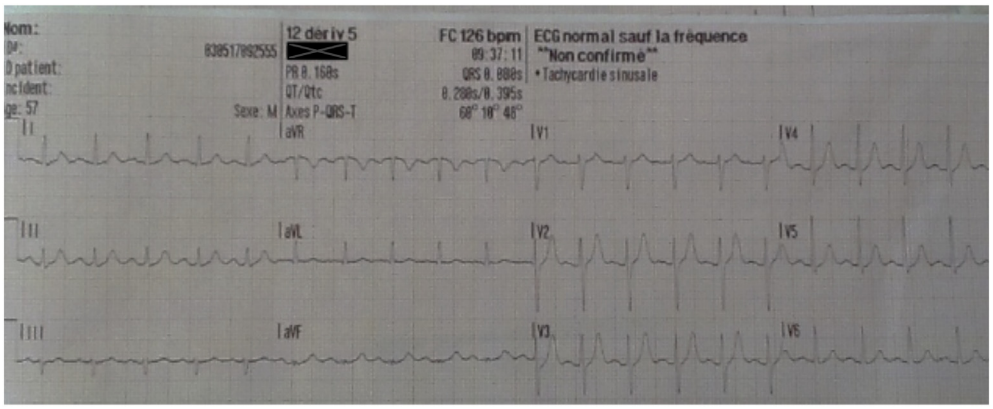

Fig. 3. Return to a sinus rhythm after the reverse Valsalva manoeuvre without swallowing.

Table 1
Demographic data, clinical characteristics and different treatments used for each supraventricular tachycardia case.

Characteristics	Sex	Age	Medical history	Current medical particularity	mVM/sVM before rVM	Pharmacological agents before rVM	Reversion success with rVM
Patient 1	Male	55	SVT	None	No	No	Yes
Patient 2	Male	57	None	None	Yes	No	Yes
Patient 3	Male	51	Heart transplantation	None	Yes	Yes	No
Patient 4	Female	70	SVT	None	Yes	No	Yes
Patient 5	Female	32	SVT	Pregnant	No	No	Yes
Patient 6	Female	42	SVT	None	No	No	Yes
Patient 7	Male	50	SVT	None	Yes	Yes	Yes
Patient 8	Male	48	SVT	None	Yes	No	Yes
Patient 9	Male	43	SVT	Otitis	No	No	Yes
Patient 10	Male	27	Chronic renal failure dialysis	None	No	No	Yes
Patient 11	Male	62	SVT	None	No	No	Yes

SVT: supraventricular tachycardia.
sVM: standard Valsalva manoeuvre.
mVM: modified Valsalva manoeuvre.
rVM: reverse Valsalva manoeuvre.

perform the rVM, which arrested the tachycardia and allowed a return to sinus rhythm.

3.10. Case 11

A 62-year-old patient with a history of SVT called because of an acute episode of palpitations. The medical dispatcher helped the patient perform the rVM, which resolved the crisis. When the physician-staffed EMS arrived at the patient's home, they observed the patient's return to sinus rhythm.

4. Discussion

SVT is a common and recurrent pathology in emergency medicine. In the majority of cases, SVT is a recurrent episode of a known supraventricular rhythm disorder. SVT is very rarely associated with severe episodes that require hospitalisation. It is resolved by the immediate disappearance of all symptoms, thus allowing the patient to remain at home. Unfortunately, its resolution is rarely spontaneous. Vagal manoeuvres have long been known as a non-invasive and potentially effective treatment for SVT (apart from flutter and atrial fibrillation) (1). Two recent studies [2,3] have shown that the mVM is more effective than the sVM for resolving SVT (43% versus 20%, respectively). A primary goal is to increase the non-invasive therapeutic arsenal of emergency physicians so that they can rapidly arrest SVT episodes and avoid patient hospitalisation. The scientific literature on this subject is not as abundant as hoped, apart from reviews and case reports, which today tend to advocate that these patients no longer be systematically hospitalised [5].

Here, we describe a new vagal manoeuvre that is simple to perform, “administrable” by telephone and which can be carried out alone by the patient, an aspect that was not possible with the mVM. The pathophysiology of the vagal mechanism of the reverse Valsalva method (without swallowing), described in the literature as the Toynbee manoeuvre, is identical to that of the sVM. The patient increases the intrathoracic pressure during inspiration against resistance, which leads to the baroreceptors stimulating the vagus nerve and inhibiting the sympathetic system responsible for bradycardia and hypotension. This case series describes the effectiveness of this technique. Its ease of use and ability to be performed autonomously by the patient are also important elements given the significant prevalence of this pathology in the population (2.25 cases per 1000 people) [6]. A randomised controlled trial is now necessary to evaluate the effectiveness of this new therapeutic technique for the non-invasive management of SVT.

5. Conclusion

The reverse Valsalva manoeuvre without swallowing is described here for the first time as a vagal manoeuvre in the context of arresting SVT. This manoeuvre holds much research interest. The rVM should be compared with the currently used vagal manoeuvres for treating SVT to determine whether it can be an alternative method or whether, because of its greater effectiveness and simplicity of teaching and execution, it should become the method of choice in the first-line treatment of SVT.

CRediT authorship contribution statement

Philippe Gaudart: conceptualization; data curation; Validation; Writing: review & editing. **Nicolas Cazes**: writing - original draft; Formal analysis; Methodology; Writing: review & editing. **Kimberley Simon**: Investigation; Writing – original draft. **Denis Larger**: Resources; Software; Visualization. **Jean-Claude Deharo**: conceptualization; Supervision; Validation; Writing - review & editing.

Declarations of interest

None.

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