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CLASSIC CASE REPORT
Electrophysiology

Atrioventricular nodal reentry tachycardia in pregnancy: 'I have ice for you'

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Background Pregnancy is a known trigger of novel and pre-existing supraventricular tachyarrhythmias. We present a case of a stable pregnant patient presenting with atrioventricular nodal reentry tachycardia (AVNRT) and application of the 'facial ice immersion technique'.

Case summary A 37-year-old pregnant woman presented with recurrent AVNRT. Due to unsuccessful attempts of conventional vagal manoeuvres (VMs) and refusal of pharmacological agents, we successfully performed a non-conventional VM with the 'facial ice immersion technique'. This technique was applied successfully at repeated clinical presentation.

Discussion The role of non-pharmacological interventions remains pivotal and may lead to desired therapeutical effects without the use of any costly pharmacological agents with possible adverse events. However, non-conventional VMs such as the 'facial ice immersion technique' are less commonly known but appear to be easy and a safe option for both mother and foetus in the management of AVNRT during pregnancy. Clinical awareness and understanding of treatment options are imperative in contemporary patient care.

Keywords Pregnancy • Supraventricular tachyarrhythmias • Vagal manoeuvres • Facial ice immersion technique • Case report

ESC Curriculum 5.5 Supraventricular tachycardia • 5.1 Palpitations • 9.8 Pregnancy with cardiac symptoms or disease

Learning points

- Awareness of contemporary guidelines-based treatment strategies of pharmacological and non-pharmacological interventions in pregnancy
- When haemodynamically stable, vagal manoeuvres are considered the first-line choice for treatment of supraventricular tachyarrhythmias.
- Awareness for conventional and non-conventional applications of vagal manoeuvres in daily clinical practice

Introduction

Pregnancy is known to trigger novel and pre-existing supraventricular tachyarrhythmias (SVT).[1] Patients presenting with haemodynamic instability caused by SVT should primarily be treated with an emergency synchronized cardioversion. Though, when patients are more stable, vagal manoeuvres (VMs) are considered as first choice treatment strategy. We describe a patient who presented with a SVT and the application of non-conventional VM in the context of different treatment strategies in this patient population.

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Timeline

Day 0	first presentation with supraventricular tachyarrhythmias and successful application of 'facial ice immersion technique'
Day 33	recurrent tachyarrhythmia that terminated by application of carotid sinus massage (performed by her partner)
Day 47	first outpatient follow-up post-'facial ice immersion technique', electrocardiogram demonstrated sinus rhythm
Day 52	second presentation with recurrent supraventricular tachyarrhythmias and repeated successful application of 'facial ice immersion technique'

Case presentation

A 37-year-old pregnant woman (first trimester) with a reported history of among others anorexia nervosa, diabetes mellitus type 1, and renal–pancreas transplant in 2015 (diabetic nephropathy). Moreover, she had a history of recurrent atrioventricular nodal reentry tachycardia (AVNRT) without structural heart disease since 2012, with no effect of modified Valsalva manoeuvre (MVM) or carotid sinus massage (CSM). She was using verapamil as a pill-in-the-pocket and declined a catheter ablation.

She was admitted to the internal medicine ward due to hyperemesis gravidarum and possible tacrolimus intoxication. The cardiology department was consulted due to a symptomatic narrow complex tachycardia with possible haemodynamic instability. At primary assessment, the patient had a lowered level of consciousness (Glasgow Coma Scale: E3M5V4[2]) and reported general malaise, chest pain, dyspnoea, and heavy palpitations. Vital signs at presentation were notable with a regular

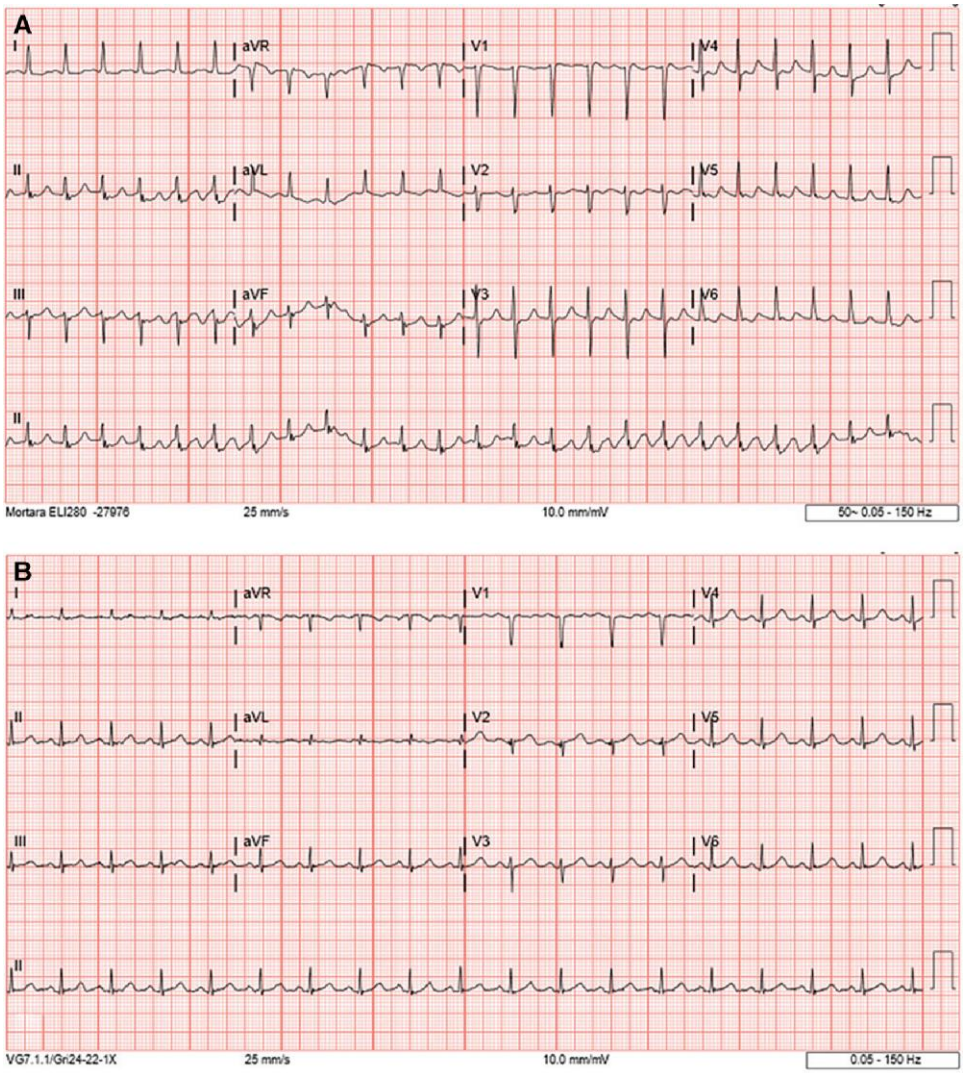

Figure 1 Electrocardiograms before and after conversion by facial ice immersion. *A* demonstrates a 12-lead electrocardiogram with a regular narrow complex tachycardia with a frequency of ~150 b.p.m. Notice the retrograde P waves that are best observed in lead II, and slight ST depression in lead II, aVF, and V4. Furthermore, we observed a short RP interval (<50% of R–R interval) and pseudo S wave in lead III and aVF. *B* demonstrates a 12-lead electrocardiogram with a normal sinus rhythm with a frequency of ~100 b.p.m.

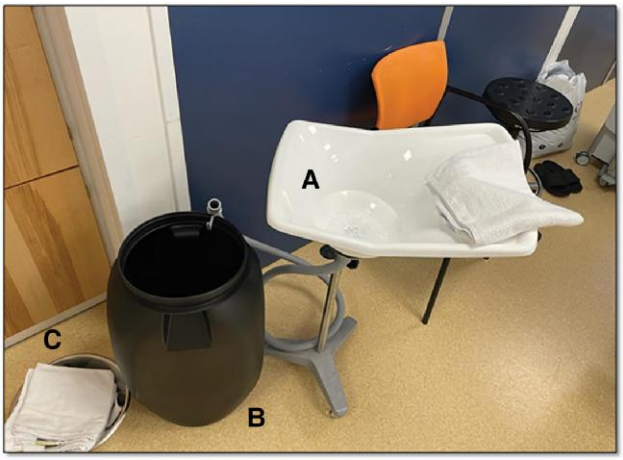

Figure 2 Clinical set-up post-application of facial ice immersion technique. Figure 2 demonstrates the clinical set-up after application of the 'facial ice immersion technique'. The patient was instructed to place her head on the salon sink (indicated by *A*). The sink was filled with a large bowl containing ice water (indicated by *C*). The ice water was drained into a large bin (indicated by *B*).

tachycardia of 150 b.p.m. and a blood pressure of 80/50 mmHg, which improved to 100/60 mmHg after saline infusion. Respiratory examination was normal. Further physical examination demonstrated bilateral, pulsatile, bulging jugular veins consistent with the classical 'Frog Sign'.[3] Electrocardiogram (EKG) showed a narrow complex tachycardia most suspicious for recurrent typical form of AVNRT (*Figure 1*A).[3,4] Biochemically, the patient had a normal haemoglobin level (7.6 mmol/L; normal range 7.5–10.0 mmol/L) and slightly low potassium level (3.7 mmol/L; normal range 3.8–5.2 mmol/L). The renal and thyroid functions were normal, and inflammation parameters were low.

According to the ESC guideline,[5] we primarily performed MVM and CSM that were both unsuccessful. The patient refused any kind of pharmacological medication that might be harmful to the foetus.

Due to unsuccessful attempts of MVM and CSM and refusal of pharmacological agents, we performed the 'facial ice immersion technique' (*Figure 2*).[6] Under continuous rhythm monitoring and informed consent, her face was lowered in a bowl of ice water. Within mere seconds post-immersion, the tachyarrhythmia converted to a normal sinus rhythm (*Figure 1*B). The patient regained full consciousness and reported no more complaints. After a brief period of monitoring at the emergency cardiac care unit, she returned to the internal medicine ward and was scheduled for outpatient cardiac follow-up.

During follow-up at the outpatient clinic, the patient reported several episodes of paroxysmal tachyarrhythmias. These events were self-limiting, except for one time, when the tachyarrhythmia was terminated by application of CSM (performed by her partner). We performed an echocardiography that showed no structural abnormalities, and EKG showed normal sinus rhythm. The patient declined a catheter ablation due to her current pregnancy. She preferred to postpone this procedure until the postpartum period.

Shortly after the outpatient consult, the patient was re-admitted due to hyperemesis gravidarum (at 16 weeks pregnancy). Once more, the cardiology department was consulted due to a narrow complex tachycardia most suspicious for recurrent typical AVNRT. We performed MVM and CSM that were both unsuccessful. Again, the patient refused any kind of medication that might potentially be harmful for the foetus. Therefore, we applied the 'facial ice immersion technique' after which the tachycardia converted to a normal sinus rhythm within mere minutes. The patient was instructed in case of recurrent episodes and will be scheduled for catheter ablation postpartum.

Discussion

Pregnancy is a well-known trigger for (pre-existing) tachyarrhythmias. The precise mechanism is still not fully elucidated, but it is most likely a combination of hormonal, haemodynamic, and autonomic changes that may lead to these events.[1] Ideally, management of tachyarrhythmias should be performed before conception. However, this is not always achievable. Fortunately, severe tachyarrhythmia in pregnancy that requires aggressive intervention is rare.

Patients presenting with haemodynamic instability caused by SVT should primarily be treated with an emergency synchronized cardioversion. However, when patients are more stable, VM are considered the first-line choice. When these manoeuvres are ineffective, a pharmacological agent such as intravenous administration of adenosine is reported as the drug of choice for acute conversion. However, little is known about pharmacological management of SVT in pregnant women regarding the possible damage to the foetus. Particularly concerning is the foetal effects in the first trimester when organogenesis occurs.[1] Therefore, the role of non-pharmacological interventions remains pivotal and may lead to desired therapeutical effects without the use of any possibly damaging and costly pharmacological agents.

The VMs are techniques that are used to increase the vagal parasympathetic tone. This may be helpful in diagnosing and treating various SVT. Well known techniques are MVM and CSM. However, less known manoeuvres such as the 'facial ice immersion technique' or the 'diving reflex' can also be used when the aforementioned strategies fail. This strategy has been described previously in several case series in paediatric patients, in which the 'facial ice immersion technique' appears to be a successful, safe, effective, and non-invasive treatment for paediatric patients with SVT.[7] The main theory is that exposure to extremely cold water triggers a reflex causing afferent impulses from the trigeminal nerve (cranial nerve V), the predominant sensory nerve of the face. The impulses then stimulate vagal nuclei in the brain that slow down the AV nodal conduction.[6] This strategy can be repeated several times. Although there is no real contra-indication, patients should be informed, and measures should be taken to avoid events such as post-traumatic stress, ice burns, aspiration, and airway obstruction, especially in high-risk patients.

In conclusion, the 'facial ice immersion technique', a non-pharmacological intervention, provides an easy and safe option for both mother and foetus in the management of an AVNRT during pregnancy. Clinical

awareness and understanding of this option are imperative in contemporary patient care.

Lead author biography

Rachid Abou received his MD degree in 2014 and finalized his PhD entitled 'The role of advanced echocardiography in patients with ischemic heart disease' in 2021. Currently, he is working at the Leiden University Medical Center as a resident at the Department of Cardiology.

Supplementary material

Supplementary material is available at *European Heart Journal – Case Reports*.

Slide sets: A fully edited slide set detailing this case and suitable for local presentation is available online as Supplementary data.

Consent: The authors certify that they have obtained patients consent, in accordance with COPE guidelines. The patient has given her consent for these images and other clinical information to be reported in the journal. The patient understands that name and initials will not be published. Efforts have been made to guarantee patient anonymity.

Conflict of interest: None declared.

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Data availability

The data underlying this article are available in the article and in its online supplementary material.

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