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Paroxysmal Atrial Fibrillation Induced by Ice-Cold Water Ingestion in a Triathlete: A Case Report

Authors' Contribution:

Study Design A

Data Collection B

Statistical Analysis C

Data Interpretation D

Manuscript Preparation E

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Patient: Male, 35-year-old
Final Diagnosis: Swallowing-induced atrial fibrillation
Symptoms: Atrial fibrillation
Medication: —
Clinical Procedure: —
Specialty: Cardiology • Sports Medicine

Objective: Unknown etiology**Background:** Swallowing-induced tachyarrhythmias are rare, and their possible mechanisms are still not completely elucidated. Even though a mechanical stimulation has been suggested, involvement of the autonomic nervous system has not been completely excluded. Moreover, tachyarrhythmias are not so frequent in athletes.**Case Report:** We present a case of a 35-year-old male triathlete who reported palpitations after swallowing ice-cold water following physical activity. His physical examination and basal electrocardiogram were essentially normal. The 24-h Holter monitoring showed a sinus rhythm with sporadic isolated supraventricular ectopic beat and a 2-h run of atrial fibrillation (160-200 beats/min). This episode of paroxysmal atrial fibrillation was related to and occurred after the ingestion of ice-cold water following physical exercise. We were able to reproduce this event. Notably, the tachyarrhythmia was only triggered by swallowing ice-cold water; nothing happened with room-temperature water. No therapy was given to the triathlete to avoid influencing his physical performance in any way.**Conclusions:** This case suggests that both an esophageal mechanical stimulation and autonomic nervous system involvement were at the base of this tachyarrhythmia. The influence of water temperature on the esophageal thermoreceptors has to be considered.**Keywords:** Athletes • Atrial Fibrillation • DeglutitionFull-text PDF: <https://www.amjcaserep.com/abstract/index/idArt/931460>

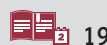
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Background

Athletes are universally considered to be healthy individuals, but several studies have reported that they have an increased risk of atrial fibrillation (AF) up to 2-10 times higher than that of sedentary subjects [1,2]. This increased risk is more frequently observed in middle-aged athletes compared with young athletes [3]. The reason for this increased risk is not completely clear. Possible mechanisms could be left atrial enlargement, left ventricular remodeling (hypertrophy and dilatation), and an increased parasympathetic tone [4].

Episodes of paroxysmal atrial fibrillation may be precipitated by the rapid ingestion of ice-cold beverages, but this condition has received little research attention. In fact, swallowing-induced tachyarrhythmias are rare, and they typically include paroxysmal atrial tachycardia, premature atrial contractions, and paroxysmal AF without any esophageal or cardiac abnormalities [5-8].

Despite deglutition-induced tachyarrhythmias being reported as a consequence of coronary grafting or ventricular aneurysmectomy and in association with an Eisenmenger ventricular septal defect [9,10], the mechanisms underlying swallowing-induced arrhythmias are still a matter of debate and the data behind them are limited.

Case Report

A 35-year-old male triathlete came to our attention with a 3-year history of palpitations induced by the ingestion of ice-cold water after physical activity. During these episodes, he had measured his heart rate as being up to 150 beats/min.

Physical examination was essentially normal. Basal electrocardiogram showed normal sinus rhythm and no abnormalities of PR interval, QRS duration, or QT interval.

Echocardiography showed a normal left ventricle size and wall thickness with normal systolic and diastolic function. A mild dilatation of the aortic root and slight mitral and tricuspid regurgitation were observed. The left atrium had a normal volume.

A technetium (^{99m}Tc) tetrofosmin stress test demonstrated an estimated ejection fraction of 58% in the absence of exercise-provoked perfusion or wall motion abnormalities. In addition, the patient's exercise tolerance was good, with the achievement of 98% of the age-predicted maximum heart rate.

The upper gastrointestinal barium study was normal.

The 24-h Holter monitoring showed a sinus rhythm with sporadic isolated supraventricular ectopic beat and a 2-h run of atrial fibrillation (160-200 beats/min). This finding correlated with the episode of "racing heartbeat" after cold-water ingestion reported in the patient's clinical diary (Figure 1).

Interestingly, our provocation study, performed with the oral consent of the participant, reproduced the atrial fibrillation when the patient swallowed ice-cold water after physical activity; however, nothing happened when he swallowed room-temperature water.

The patient was prescribed β -blockers, but there was no improvement in the frequency of episodes. Noting the strict connection between cold-water ingestion and atrial fibrillation, we decided to stop therapy to avoid interfering with the athlete's physical activity. He simply stopped swallowing ice-cold water and no more "racing heartbeat episodes" occurred in the following 1-year period.

Our provocation study was approved by our Ethics Committee.

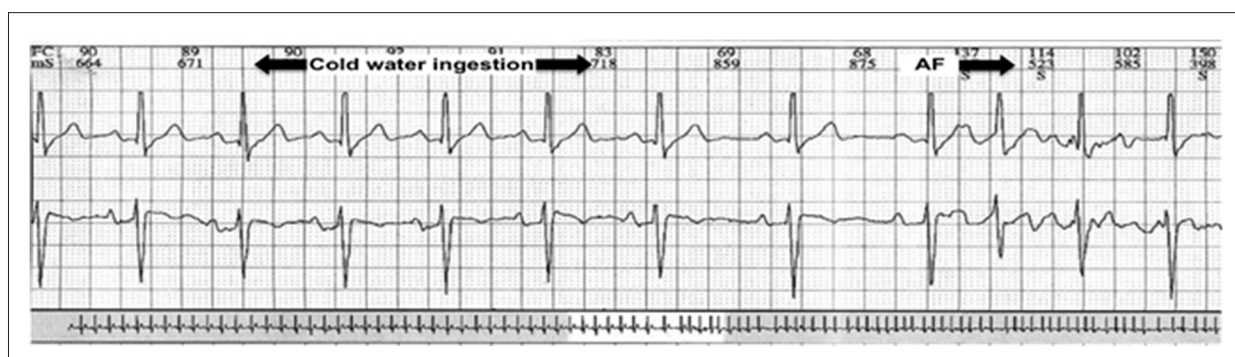


Figure 1. Atrial fibrillation (AF) onset. Before ice-cold water ingestion, a sinus rhythm can be observed; deglutition triggers the arrhythmia.

Discussion

This case showed a close correlation between ice-cold water ingestion and atrial fibrillation after physical activity. There were at least 3 prominent factors involved in the genesis of the arrhythmia: the mechanism of swallowing, the increased vagal tone after physical activity, and the ice-cold water ingestion.

Several studies have suggested that stimuli of a mechanical nature could induce this kind of tachyarrhythmia. Cohen et al [11] were able to induce AF by inflating a balloon at the level of the left atrium, suggesting that distension of the esophagus during food passage could mechanically stimulate the left atrium. AF receded when the balloon was deflated. Although this theory is interesting, reproducibility was inconsistent. In another study, the phenomenon occurred only about 50% of the time with dry swallowing [8].

Nevertheless, it has to be considered that the afferent and efferent branches of the vagus nerve are activated during a rise in intraesophageal pressure. The resulting vasovagal reflex could trigger the atrial ectopic activity, leading to an atrial fibrillation [12].

Moreover, the increased vagal tone after physical activity in our athlete could play an important role in triggering AF after water ingestion [13]. In fact, vagal stimulation of the atrial myocardium is able to shorten the refractory period of atrial tissue and induce atrial ectopic activity leading to circuitous pathways and resulting in supraventricular tachyarrhythmias [14-16].

However, some evidence suggests involvement of the sympathetic system. For example, Shirayama et al [5] described a patient in whom the swallowing tachyarrhythmia followed an increase in atropine and catecholamines.

In this regard, it should be noted that in our patient, atrial fibrillation was caused only by ice-cold water ingestion; nothing happened when he swallowed room-temperature water. The reaction to ice-cold water only may have occurred because of an activation of cold esophagus thermoreceptors leading to an adrenergic reflex; the consequent sympathetic hypertone would cause asynchrony in the recovery time, with a focal reentry and subsequent atrial tachyarrhythmias [17].

Cold water could also increase cold oxidative stress parameters that have been demonstrated to be involved in triggering atrial fibrillation, as recently suggested by Tascanov et al [18].

One of the interesting things is that the ice-cold water ingestion and the consequent adrenergic response happened just as physical activity stopped and the vagal tone prevailed on the sympathetic one.

This “autonomic conflict,” intended as a rapid co-activation of the 2 branches of the autonomic nervous system, could be at the base of this swallowing-induced AF [19].

As far as the treatment, a satisfactory control can be achieved with a variety of drugs, including β -blockers, class I antiarrhythmic drugs, verapamil, and amiodarone, but given that the real cause of these swallowing-induced arrhythmias is still unclear, drugs could worsen them.

Surgery has been considered as an extreme choice in selected cases by repositioning the esophagus or by surgical denervation or removal of direct stimulation [10].

Conclusions

Our case suggests that there are different mechanisms at the base of swallowing-induced AF, and the esophageal stimulation may be a possible trigger of an unknown number of clinical tachyarrhythmias. In addition, both vasovagal and adrenergic reflexes appear to be involved.

Moreover, it should be considered that their possible simultaneous activation is precipitated by the stimulation of cold thermoreceptors in the context of vagal hypertone.

Further studies are needed to completely elucidate whether a swallowing-induced tachyarrhythmia is simply a direct cause-to-effect phenomenon or a more complex one involving a neural mechanism.

Conflict of Interest

None.

Declaration of Figures Authenticity

All figures submitted have been created by the authors who confirm that the images are original with no duplication and have not been previously published in whole or in part.

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