Establishing stable sinus rhythm in an endurance athlete with paroxysmal supraventricular tachycardia improves haemodynamical performance during exercise testing

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DESCRIPTION

Atrial fibrillation is a commonly known heart rhythm abnormality that occurs not only in the general population but also in endurance athletes. Various studies have even described an increased prevalence among athletes.^{1–4}

We recently presented the case of a well-experienced 60-year-old man endurance Ironman-triathlon athlete (187 cm, 92 kg, average training level: 10–15 hours/week) who had presented with intermittent shortness of breath and heart palpitations during his training sessions in his daily routine.⁵ His medical history showed an isthmus ablation caused by typical atrial flutter and a clinically stable arterial hypertension. The echocardiographic data showed a normal size of the left ventricle (left ventricular end diastolic diameter (LVEDd) 42 mm), no hypertrophy of the left ventricular walls (interventricular septum thickness (IVSd) 11 mm, posterior wall thickness in systole (PWTs) 11 mm), a minimal enlargement of the left atrium (LA 21 qcm) and a normal ejection fraction (55%). Cardiopulmonary exercise testing (CPEX, ergometer bike) revealed an episode of paroxysmal supraventricular tachycardia (SVT, maximum effort 250 W). We were able to graphically record the degree to which the athlete's performance was reduced (figures 1 and 2). The patient's oxygen pulse decreased pathologically and his VO_2 oxygen uptake during the SVT was limited (figures 1 and 2).

In the course of a recently conducted further examination and therapy of the same patient, we performed an electrophysiological examination with an ablation of the pulmonary veins (pulmonary vein isolation with a three-dimensional mapping system) and re-evaluated the patient's clinical performance with a further echocardiographic examination and a CPEX on an ergometer bike. The echocardiographic data showed a stable trend in the follow-up appointment (LVEDd 43 mm, IVSd 11 mm, PWTs 11 mm, LA 20 qcm, normal ejection fraction 55%–60%). After the CPEX testing, the patient recovered fast and no episodes of SVT were detected. The haemodynamic influence of the established stable sinus rhythm was recorded graphically in the comparison of pre-interventional and postinterventional CPEX figures (figures 1 and 2 vs figures 3 and 4).

Figure 1 Impairment of the oxygen pulse during the cardiopulmonary exercise caused by atrial fibrillation (starting within minute 11) and showing the gap between the tachycardia (red colour) and oxygen pulse (blue colour).

Our case graphically shows the haemodynamic influence of a paroxysmal atrial fibrillation and the consequent reduced performance of a patient during CPEX. According to the clinical appearance and the athlete's reporting, it highlights the

Figure 2 Graphical record of the athlete's impairment referring his VO_2 max uptake caused by atrial fibrillation, missing the typical levelling off phenomenon by endurance athletes at the end of the cardiopulmonary exercise testing.

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Figure 3 Process of the oxygen pulse during cardiopulmonary exercise with stable sinus rhythm in comparison to figure 1 without the gap between heart rate (red colour) and oxygen pulse (blue colour).

impact of a stable sinus rhythm on the performance of endurance athletes.^{2,3}

In this context, we recently presented our first findings before establishing a stable sinus rhythm.⁵ By mapping the LA during the electrophysiological examination with an ablation of the pulmonary veins (pulmonary vein isolation with a three-dimensional mapping system), signs of atrial myocardial fibrosis could be

Figure 4 Graphical record of the athlete's VO_2 max uptake without the impairment in figure 2 and the typical levelling off phenomenon by endurance athletes at the end of the cardiopulmonary exercise testing.

Learning points

- The presented follow-up investigation of our previously published case graphically shows the haemodynamic effect of recovery of a stable sinus rhythm after prior paroxysmal supraventricular tachycardia on the athlete's performance during a cardiopulmonary exercise test.
- Although different pathological mechanisms for underlying etiological reasons are discussed, maximum efforts should be focused on establishing a stable sinus rhythm in endurance athletes in order to improve their cardiac function and exercise capacity.
- Therapeutic approaches should be individually tailored according to the athletes' demands.

detected in our athlete. This is one of the various aspects of this condition, which are widely discussed, presupposing the relation between high endurance training and the prevalence of atrial fibrillation.¹⁻⁴ Causes for the higher prevalence of atrial fibrillation include: (1) myocardial fibrosis, which is sometimes caused by the accumulation of lifelong training hours and increased atrial filling pressure,⁴ (2) varying amplitude of the autonomic nervous system, (3) increased baroreflexive responsiveness and (4) increased sensitivity of cardiomyocytes to cholinergic stimulation.^{1,6}

The development of atrial fibrillation in endurance athletes with prior ablation of atrial flutter is a commonly known occurrence.⁶ The recently reported 'paroxysmal AF in young and middle-aged athletes' (PAFIYAMA) syndrome is also an interesting fact in this context; our athlete might fulfil these criteria.^{7,8}

In summary, the presented case shows the importance of establishing a stable sinus rhythm in endurance athletes to improve their haemodynamical performance in CPEX. As mentioned above, these facts have been graphically proved and our findings emphasised the importance of an individualised patient's treatment strategy in PAFIYAMA syndrome. Therefore, a sustained cardiac functional improvement after establishing a stable sinus rhythm suggests an improvement of quality of life and an objective improvement of cardiac function and exercise capacity in these athletes/patients.⁹⁻¹¹

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