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# The sudden cardiac death of a young athlete: Recommendations for a sensible and effective preventive exam

Sudden cardiac death during exercise and sport is often the first, but sadly definite manifestation of an unrecognised, underlying, often asymptomatic heart disease. While it is an extremely rare event, the enormous tragedy always raises the question of whether it could have been avoided with appropriate preventive measures.

In 1998 the Swiss Society of Sports Medicine (SGSM) published one of the first official international recommendations to prevent sudden cardiac death. Overall, this recommendation still widely corresponds to today's level of knowledge.

After the landmark publication of Corrado et al. in which they followed 12- to 37-year-old competitive athletes over 25 years with a 12-lead ECG that lead to a reduction of sudden cardiac death by 89%, rethinking has started worldwide. While a targeted medical history (questionnaire in accordance with the "Lausanne Recommendations" of the IOC) and a clinical exam was also included, the significance of an ECG at rest in the prevention of sudden cardiac death was undoubtedly proven.

## Frequency and causes of sudden cardiac death in competitive sport

Expressed per 100 000 persons and year the incidence varies between < 1 and 3 depending on age, sex and intensity of sports activity. In most cases there is an organic heart disease.

With healthy hearts the primary cause is commotio cordis that especially occurs in young athletes with a flexible thorax. While in athletes older than 35 years the majority of cases of sport associated sudden cardiac death are related to coronary heart disease and/or a heart attack, there is a wide range of causes (with large regional differences) in athletes under 35 years. While hypertrophic cardiomyopathy (HCM), followed by coronary anomalies, myocarditis and arrhythmogenic right ventricle cardiomyopathy (ARVC) are the most frequent reasons in the USA, the ARVC and coronary heart disease and/or coronary anomalies are the leading causes in Italy.

## Significance of an ECG at rest in the prevention of sudden cardiac death

The medical history and a clinical exam are established and simple methods to discover some organic heart conditions. Their sensitivity is limited, however, in particular in the case of asymptomatic progression of disease and a negative family history for cardiovascular disease. Nevertheless, in case of any suspicion further targeted investigations can be introduced.

The primary use of specific cardiologic investigations (such as stress ECG or MRI) with limited sensitivity and specificity in an

unselected population has been internationally rejected due to the high rate of false positive and sometimes also negative results.

The Italian screening programme has now, despite some limitations, clearly shown that the regular use of a resting 12-lead ECG in addition to a medical history and a clinical exam to be an appropriate tool to discover potentially fatal heart disease.

Based on Corrado's data, 8.9% of about 33,000 athletes needed further investigations based on suspicious ECG changes, and in 1.8% a complete competitive ban was issued. To achieve a better specificity of resting ECG's, a special training of the examiners allows to better separate the unspecific and/or sports related physiological from the pathological ECG changes. Nevertheless, in athletes with an early stage of HCM 82% showed already a distinct pathological resting ECG, while medical histories and exams without ECG (in spite of existing HCM) only lead to 23% of further investigations.

## Efficiency of the new preventive measures with resting ECG

The impressive reduction in frequency of sudden cardiac death by 89% in young athletes, with a regular annual medical exam and a resting ECG every 1–2 years, has shown that a new era in the prevention of sudden cardiac death has begun. The success in Italy was only possible, because the whole endangered population received the licence only after completion of the test programme.

After the medical commission of the IOC had accepted the resting ECG as a prevention programme in 2004, the Consensus Group of the European Society of Cardiology decided to include a 12-lead ECG at rest every 1–2 years into their new "European protocol for cardiovascular pre-participation screening of competitive athletes" in 2005 alongside with the annual clinical exam and medical history. Since, a range of European committees consider the ECG performed every one to two years to be sensible and effective. Some of them even request the preventive exam as a condition for receiving the competition licence for all ages.

## Cost-benefit considerations

Preventive exams of a large population cause costs that must be taken into consideration. The "integration" of a resting ECG every 1–2 years costs approximately 15–30 CHF per year in addition to the usual costs of examination. The SGSM holds that these costs should be covered by the athletes and/or the associations or clubs, while health insurance companies should pay the costs for further investigations of unclear findings. Due to the large number of lives saved, the costs for one saved life are well below 50 000 CHF, an

amount which is stipulated by the WHO as the threshold for a cost effective preventive measure.

Although the screening investigations are generally recommended for all competitive athletes, it must be mentioned that the risk of sudden cardiac death is significantly increased if intensive competition is involved. The preventive strategy should therefore focus on this population. According to the SGSM, this would basically include all competitive athletes, i.e. all athletes in individual sports as well as athletes in the top two leagues of team sports and the national teams (from 14 years). As preventive measures are only effective if the whole at risk population is examined, the reception of a licence and/or the Swiss Olympic Card should be bound to the recommended medical exam.

### **Where do we stand in Switzerland?**

With the exception of ice hockey (resting ECG since 2001), football, cycling and skiing, cardiologic preventive exams are still poorly defined and carried out very irregularly. Overall there is a considerable lack of understanding that especially young people would benefit most from these investigations.

### **SGSM recommendations to prevent sudden cardiac death in competitive sport**

Based on the newest scientific data and the experiences of various European states, SGSM recommends to perform an annual preventive investigation of all competitive athletes, above 14 years of age. The exam should incorporate a medical history, clinical exam and a resting 12-lead ECG every one to two years until demission from competition. If this aim is reached, we will have an effective prevention of sudden cardiac death in top athletes.

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