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# Preparticipation cardiovascular screening in young athletes in the Netherlands

**W**hen a young athlete dies suddenly during training or competition, this has dramatic impact on the team, relatives and other young athletes. The media draw a lot of attention to this devastating moment. The question that always arises is whether this could have been foreseen with preparticipation cardiovascular screening of the athlete.

The incidence of exercise-related sudden cardiac death in the Netherlands is 3.3/100.000 athletes a year; in Italy the incidence is 2.1/100.000 athletes a year and in the United States this is 4.1/100.000 athletes a year.<sup>1-3</sup> The incidences in the Netherlands and in the United States are derived from retrospective analysis, while the incidence in Italy is from a prospective study. In the latter study, the authors found a 10-fold higher relative risk for men to die suddenly in relationship to female athletes, and a 2.5-fold higher relative risk for young competitive athletes to die suddenly compared with the noncompetitive young population.<sup>3</sup> The Netherlands is becoming a sports nation, with 400 top-level athletes and >25% of the population registered with one or more sports federation (NOC\*NSF personal communication). In Italy about 10% of the population is registered as a competitive athlete.

Causes of exercise-related sudden cardiac death in young athletes (<35 years) are mostly due to inherited or congenital cardiac disorders. Hypertrophic cardiomyopathy (HCM) is the most common cause of exercise-related sudden cardiac death in the United States (30%), followed by congenital coronary anomaly (13%).<sup>4,5</sup> In Italy the most common cause of exercise-related sudden cardiac death is arrhythmogenic right ventricular cardiomyopathy (11%), followed by myocarditis (6.1%).<sup>3</sup> The low incidence of HCM in Italy probably relates to the fact that these postmortem studies are performed in a time window during which preparticipation screening is already performed. In older athletes (≥35 years), however, exercise-related sudden cardiac death is often due to atherosclerosis. The effect of strenuous exercise on the heart in young athletes is not well known and it is poorly understood how strenuous exertion can provoke (electrical) cardiac abnormalities and eventually lead to sudden cardiac death.

Regarding Europe, there are not many data on preparticipation screening, except from Italy, where preparticipation cardiovascular screening has been performed according to law since 1961. A competitive athlete is screened every year by personal history including family history, physical examination (including blood pressure on both arms) and a 12-lead resting ECG. If indicated further noninvasive cardiac evaluation, such as transthoracic echocardiography, exercise testing or Holter monitoring, and invasive cardiac evaluation, such as cardiac catheterisation or electrophysiological study, will be performed.<sup>6</sup> In a prospective study in Italy in 1979 to 1996,

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Corrado's group evaluated all data of 33,735 young athletes who participated in this yearly cardiovascular screening method: 1058 of these athletes were disqualified from competitive sports because of noncardiac (n=437) and cardiac (n=621) causes. Cardiovascular reasons for disqualification were electrical disease (38%), hypertension (27%), valvular disease (21%), hypertrophic cardiomyopathy (4%), and other cardiac disorders (10%). In a retrospective analysis of postmortem data of athletes who died suddenly in relation to exertion (n=49), causes of death were arrhythmogenic right ventricular cardiomyopathy (n=11), premature atherosclerosis (n=9), congenital coronary anomaly (n=8), and hypertrophic cardiomyopathy (n=1). The authors concluded that preparticipation cardiovascular screening in young athletes, including 12-lead resting ECG, could identify athletes at high risk for exercise-related sudden cardiac death with a reasonable certainty. Disqualification of those athletes who are at high risk will reduce the incidence of exercise-related sudden cardiac death. Disqualification does not always imply definitive exclusion from competitive sports, because many cardiovascular diseases can now be treated. At follow-up, the athlete will be re-evaluated for competitive sports eligibility according to the recommendations.<sup>7</sup>

In the Netherlands preparticipation screening, consisting of personal history and physical examination, was abolished in 1984. Only for national teams, diving, cycling, motor sports, parachute and gliding did preparticipation screening continue to be obligatory.<sup>8</sup>

In the European Heart Journal of March 2005, the Working Group on Sports Cardiology of the European Society of Cardiology presented a consensus document on preparticipation cardiovascular screening in young athletes and made a proposal for a common 'European protocol', consisting of personal history, focusing on symptoms especially related to exercise (palpitations, light headedness, (pre)syncope, precordial pain, dyspnoea, and unjustifiable reduction in athletic performance), family history focusing on (un)explained sudden cardiac death at a relatively young age and structural heart disease, physical examination focusing on suspicion or evidence of underlying cardiovascular pathology and a 12-lead resting ECG.<sup>6</sup> Further cardiac evaluation with (non)invasive techniques is mandatory if one of the criteria is positive. An athlete found to have a cardiovascular disease with high risk of exercise-related sudden cardiac death should be excluded from competitive sports. Almost simultaneously the 'Lausanne protocol', using the same method by questionnaire was accepted by the International Olympic Committee and the International Football Association Federation. The latter will start implementation of preparticipation cardiovascular screening with all participants of the world football championship in Germany 2006.

Recently the working group 'Cardiovascular Screening and Sports' of the Netherlands Society of Sports Physicians and the Netherlands Society of Cardiology has accepted and started implementation of the 'Lausanne protocol' in the Netherlands. This working group is supported by members of the working group 'Sports Cardiology' of the European Society of Cardiology, working group 'Cardiology & Sports' of the Netherlands Society of Cardiology, the Netherlands Society of Sports Physicians (VSG), the Dutch Olympic Committee & Sports Federations (NOC\*NSF), and the Royal Dutch Football League (KNVB). Preparticipation cardiovascular screening of young athletes (12/14 to 35 years) will be obligatory for top-level athletes, national selections and talented young athletes. For all other athletes, including older athletes (≥35 years), recreational sports, and leisure time activity, preparticipation cardiovascular screening will be promoted via the sports leagues and website [www.sportzorg.nl](http://www.sportzorg.nl).

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The ultimate goal of preparticipation cardiovascular screening of young athletes is to reduce exercise-related sudden cardiac death. After a 20-year period of not performing preparticipation screening in the Netherlands, awareness of its necessity is growing among all who participate in some kind of sports activity or sports organisation. It is still under debate if cost-effective analysis is in favour of this kind of medical activity. The cost of preparticipation cardiovascular screening in Italy, however, is estimated to be € 20 for history and physical examination and € 10 for a 12-lead ECG. For athletes younger than 18 years, costs are supported by the National Health System. Athletes older than 18 years have to pay themselves or are supported by an athletic team or federation.<sup>6</sup> Furthermore, the ethical question who will be responsible for preparticipation cardiovascular screening needs to be answered. ■

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