

Screening for heart disease in athletes

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ABSTRACT

Physical activity, be it regular exercise or sports at whatever level, should be beneficial and not deleterious. Hence, it is important that the medical profession is aware that cardiovascular related deaths are the leading cause of mortality in athletes during sports. In 2009 the International Olympic Committee issued a consensus statement on the periodic health evaluation of elite athletes. This includes ‘*a comprehensive assessment of the athlete’s current health status and risk of future injury or disease and, typically, is the entry point for medical care of the athlete*’. Although this consensus statement targeted elite athletes, the periodic health evaluation design is simple enough that it could easily be extrapolated for use for all physically active individuals. The periodic health evaluation’s role is to screen for musculoskeletal or medical conditions that may place an athlete at risk for safe participation. Since this statement was issued, numerous international sport organisations have recommended a screening programme for individuals who partake in regular physical activity. Stress is made on the importance of a thorough health and family history with an emphasis on cardiovascular issues. There is no international consensus on the use of an electrocardiogram (ECG) as part of a screening programme; however most international sports federations and the European Cardiac and Sports Medicine societies strongly recommend it. What there is agreement on is that the doctor that reads an ECG should be knowledgeable of the physiological adaptations of the athletic heart that could lead to errant, yet perfectly safe, ECG traces.

Key words:

Athlete, medical, electrocardiogram, cardiac, screening

INTRODUCTION

The role regular physical activity has in the maintenance of a healthy lifestyle is well documented (The Lancet, 2012 and 2016). In fact the following quotes are often

circulated to show the importance physicality has always held:

- Hippocrates, 5th century BC: “if one exercised they become more healthy, well-developed and age more slowly”;
- Herodotus, 440 BC: “if we could give every individual the right amount of nourishment and exercise, not too little and not too much, we would have found the safest way to health”;
- Plato, 472 BC: “lack of activity destroys the good condition of every human being, while movement and methodical physical exercise correctly save it and preserve it”.

However, physical activity, be it regular exercise or sports at whatever level, should be healthy and not deleterious. Hence it is important that the medical profession is aware that cardiovascular-related deaths are the leading cause of mortality in athletes during sports (Maron, et al., 2009; Harmon, et al., 2011). At the same time one must also not forget that musculoskeletal (MSK) issues go hand in hand with regular physical activity and even more so with contact sports (Ekstrand, Hägglund and Waldén, 2011). Although these are rarely fatal, they can have a significant effect on activities of daily living. Therefore, pre-participation screening is universally supported to identify athletes with pre-existing conditions that place them at risk of injury or an adverse cardiac event.

This paper shall focus primarily on what is recommended as a minimum requirement for the cardiovascular screening of an athlete, with MSK screening tackled in a future paper. It shall broach the subject by looking into the recommendations of the more established and recognised governing sporting authorities, namely the International Olympic Committee (IOC) and the Fédération Internationale de Football Association (FIFA), and the leading Sports and Exercise Medicine authorities in Europe and worldwide, specifically the European Federation of Sports and Exercise Medicine

(EFSMA), American College of Sports Medicine (ACSM) and the International Federation of Sports Medicine (FIMS). This paper shall not dwell on the myriads of documents that led to these recommendations, but rather view them in the local Maltese scenario.

INTERNATIONAL RECOMMENDATIONS

In 2009 the IOC issued a consensus statement on the periodic health evaluation (PHE) of elite athletes (Ljungqvist, et al., 2009). This includes *'a comprehensive assessment of the athlete's current health status and risk of future injury or disease and, typically, is the entry point for medical care of the athlete'*. Although this consensus statement targeted elite athletes, the PHE design is simple enough that it could easily be extrapolated for use for all physically active individuals. The PHE's role is to screen for MSK or medical conditions that may place an athlete at risk for safe participation. In fact the athlete may not even be aware that there is something wrong until this is revealed during a PHE. Alternatively, the athlete might have a current health problem and the PHE will serve to ensure that the medical ailment is being managed correctly and that the athlete is capable of safely undertaking physical activity at that particular moment. Amazingly, even athletes that have easy access to medical care sometimes choose to ignore, for whatever reasons, ailments that are causing significant symptoms. Other times, common asymptomatic conditions, such as a mild iron deficiency, may influence physical performance although the health of the athlete is not compromised. Ideally the PHE is undertaken early enough such that it allows sufficient time for the management of any injuries or medical problems that might be uncovered without affecting the athlete's season too much.

Periodic health evaluation requirements

According to the IOC, the general requirements of a PHE include:

- Based on sound scientific and medical criteria.
- Be performed in the primary interest of the athlete.
- Under the responsibility of a physician trained in sports medicine, preferably the physician responsible for providing ongoing medical care for the athlete, e.g. the team physician.
- The setting of the evaluation should be chosen to optimize the accuracy of the examination and respect the privacy of the athlete.
- Free and informed consent of the athlete and, if applicable, his/her legal guardian.

If the PHE provides evidence that an athlete is at serious medical risk, the physician must strongly discourage the athlete from continuing training or competing until the necessary medical measures have been taken. Based on such advice, it is the responsibility of the athlete to decide whether to continue training or competing.

If a physician is requested to issue a medical certificate, he or she must have explained in advance to the athlete the reason for the PHE and its outcome, as well as the nature of information provided to the third parties.

With the advent of many non-local athletes and the organisation of sports for all ages and physical capabilities, the PHE should be tailored to race, age, gender and be sport specific. Cultural sensitivities should also be considered. Once an injury or medical condition is identified, if deemed necessary, a referral should be organised to the appropriate specialist for further evaluation and management. The PHE is also an opportunity to assess any medications or nutritional products being used to determine if a Therapeutic Use Exemption (TUE) application to the World Anti Doping Association (WADA) is required.

Periodic health evaluation form

The PHE consists of a five-page document divided into two sections: the medical history section and the physical examination section (International Olympic Committee, 2009). The first section is thorough with an emphasis on elucidating any symptoms, signs or family history that could indicate an underlying cardiovascular issue. This cardiovascular focus is also seen in the physical examination section. This emphasis on cardiovascular evaluation of an athlete is stressed again since a 12 lead ECG is also required as part of a standard PHE. These all indicate how the prevention of sudden cardiac death in athletes remains a highly visible topic in sports and exercise medicine and cardiology.

When one is reviewing an ECG of an individual that regularly partakes in physical activity, one must note the cardiac adaptation and remodelling that regular physical training produces, which lead to common ECG alterations that could be mistaken as abnormal. Here the 'Seattle Criteria' document comes in handy as this is the outcome of the collaboration between a number of sports and exercise medicine organisations to tackle this ECG interpretation predicament (Drezner, et al., 2013). In fact, nowadays one can even acquire commercial ECG machines that have 'athlete specific' software based on

the Seattle Criteria to assist in the interpretation of the results. However, it is still highly recommended that physicians responsible for the medical care of athletes be guided by ECG interpretation standards that improve disease detection and limit false-positive results. Here one must stress again the recommendation by the IOC who encourages a referral to a specialist in the field, ideally a cardiologist attuned to the athletic heart, whenever there are any doubts.

To assist medical professionals that often have to deal with athletes, a number of free online courses have been created that tackle specifically ECG interpretation in athletes. Good examples are the British Medical Journal learning course: ECG interpretation in athletes (British Medical Journal, 2017) and the FEMEDE - La Sociedad Espanola de Medicina Del Deporte - course: Electrocardiography for sports medicine (FEMEDE, 2017).

The FIFA Pre-competition Medical Assessment (PCMA) (Dvorak, et al., 2009; Corrado, et al., 2010) follows the PHE of the IOC and involves a focused player medical history (PMH), family medical history (FMH) and cardiac specific physical medical examination. FIFA insists that a resting 12-lead ECG should be undertaken as part of the PCMA on all players at the beginning of their playing career and then once every year. (Dvorak et al 2013). However, different to the IOC PHE, the PCMA recommends that echocardiography be considered at least once in a player's early career to better detect structural disorders and should be undertaken by an experienced cardiologist and whenever abnormal results are found in the history, examination and/or ECG (Kramer, 2010). FIFA also recommends that an exercise test should be considered in athletes older than 35 years of age and when otherwise indicated. EFSMA issued a statement in 2015 indicating that without the ECG, athletic medical screening has low sensitivity and will also likely have a very low specificity (Löllgen, et al., 2015). This statement has recently been supported by a meta-analysis (fifteen papers) showing that ECG in athletes "is 5 times more sensitive than history, 10 times more sensitive than physical exam, has higher positive" and "lower negative likelihood ratio" with a "lower false positive rate" (Harmon, Zigman and Drezner, 2015).

LOCAL SCENARIO

In Malta the two larger non-governmental sports organisations, namely the Malta Football Association and the Maltese Olympic Committee, follow the lead of their parent organisations (FIFA and IOC), and require that

athletes participating in their tournaments or games have a 12 lead ECG as part of their medical screening and that the physicians that conduct the medical screening have a sound knowledge of Sports and Exercise Medicine and ECG interpretation.

However, here one must note that not all Sports and Exercise Medicine organisations believe in the need of the ECG and the Joint Consensus Statement between the American College of Sports Medicine (ACSM) and the International Federation of Sports Medicine (FIMS) 'Advancing the Preparticipation Physical Evaluation (PPE)' is an example of this (Roberts, Löllgen and Matheson, 2014). The ACSM and FIMS did not reach a consensus on ECG screening as a routine part of PPE, but agreed that a history and physical examination focusing on cardiac risk is essential, and an ECG should be used where risk is increased.

CONCLUSION

A thorough medical evaluation is a must prior to commencing any form of regular physical activity, be the athlete a weekend warrior, a walker or a professional athlete. The minimum requirements for recreational athletes are a detailed history and physical examination focusing on cardiac risk; an ECG should be used when the perceived risk is increased. For competitive athletes, a 12 lead ECG is not only recommended but might even be an essential sport federation requirement for participation. Ideally the physician undertaking the medical screening is familiar with the sport concerned and with its specific physical requirements. Maltese general practitioners that work with athletes can avail themselves of the aforementioned online ECG courses and have in place an appropriate referral procedure for any queries that might. The goal is that, one day, Malta will have the same legal requirement that is found in other countries, such as Italy, where all individuals that undertake physical activity in an organised fashion, be it as a member of a fitness club, a sport club or participation in sporting events, such as road races, must undertake a pre-participation health evaluation that will include an ECG and ideally this is undertaken with physicians that have undergone the appropriate training.

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REFERENCES

- British Medical Journal, 2017. *BMJ Learning: ECG interpretation in athletes*. Available at: <<http://learning.bmj.com/learning/course-intro/html?courseId=10042239>> [Accessed 2 January 2017].
- Corrado, D., Pelliccia, A., Heidbuchel, H., et al., 2010. Recommendations for interpretation of 12-lead electrocardiogram in the athlete. *Eur Heart J*, 31, pp. 243–59.
- Drezner, J.A., Ackerman, M.J., Anderson, J., et al., 2013. Electrocardiographic interpretation in athletes: the 'Seattle criteria'. *Br J Sports Med*, 47, pp. 122–4.
- Dvorak, J., Grimm, K., Schmied, C., et al., 2009. Development and implementation of a standardized pre-competition medical assessment of international elite football players - 2006 FIFA World Cup Germany. *Clin J Sport Med*, 19, pp. 316–21.
- Dvorak, J., Kramer, E.B., Schmied, C.M., et al., 2013. The FIFA medical emergency bag and FIFA 11 steps to prevent sudden cardiac death: setting a global standard and promoting consistent football field emergency care. *Br J Sports Med*, 47, pp. 1199–1202.
- Ekstrand, J., Häggglund, M. and Waldén, M., 2011. Injury incidence and injury patterns in professional football: the UEFA injury study. *Br J Sports Med*, 45, pp. 553–8.
- FEMEDE, 2017. Course "Electrocardiography for sports medicine". Available at: <<http://femedde.es/electrocardiographyforsportsmedicine.php>> [Accessed 2 January 2017].
- Harmon, K.G., Asif, I.M., Klossner, D., et al., 2011. Incidence of sudden cardiac death in national collegiate athletic association athletes. *Circulation*, 123, pp. 1594–600.
- Harmon, K.G., Zigman, M. and Drezner J.A., 2015. The effectiveness of screening history, physical exam, and ECG to detect potentially lethal cardiac disorders in athletes: A systematic review/meta-analysis. *JECG*, 48, pp. 329–338.
- International Olympic Committee, 2009. *Athlete PHE Form*. Available from: <<https://stillmed.olympic.org/media/Document%20Library/OlympicOrg/News/20090716-The-IOC-Consensus-Statement-on-Periodic-Health-Evaluation-of-Elite-Athletes/Athlete-PHE-form.pdf>> [Accessed 15 July 2017].
- Kramer, E.B., 2010. Football emergency medicine. *FIFA CME*, 28, pp. 208–12.
- Ljungqvist, A., Jenouire, P., Engebretsen, L., et al., 2009. The International Olympic Committee (IOC) Consensus Statement on periodic health evaluation of elite athletes. *Br J Sports Med*, 43, pp. 631–43.
- Löllgen, H., Börjesson, M., Cummiskey, J. et al., 2015. The Pre-Participation Examination in Sports: EFSMA Statement on ECG for Pre-Participation Examination. *Dtsch Z Sportmed.*, 66, pp. 151–155.
- Maron, B.J., Doerer, J.J., Haas, T.S., et al., 2009. Sudden deaths in young competitive athletes: analysis of 1866 deaths in the United States, 1980–2006. *Circulation*, 119, pp. 1085–92.
- Roberts, W.O., Löllgen, H. and Matheson G.O., 2014. Advancing the pre-participation physical evaluation: an ACSM and FIMS joint consensus statement. *Clin J Sport Med.*, 24(6), pp. 442–447.
- The Lancet, 2012. *Physical Activity 2012*. Available at: <<http://www.thelancet.com/series/physical-activity>>. [Accessed 15 July 2017]
- The Lancet, 2016. *Physical Activity 2016: Progress and Challenges*. Available at: <<http://www.thelancet.com/series/physical-activity-2016>>. [Accessed 15 July 2017].