Journal of Heart

Letter to Editor | Vol 2 Issue 1

Sudden Cardiac Death and Other Life-Threatening Cardiovascular Problems Associated with Excessive Endurance Training

Pierre A Guertin

Department of Psychiatry and Neurosciences, Faculty of Medicine, Laval University, Laval University Medical Center, Quebec City, Quebec, Canada

Correspondence should be addressed to Pierre A Guertin, paguertin@yahoo.com

Received Date: July 13, 2020; **Accepted Date:** July 25, 2020; **Published Date:** August 02, 2020

ABSTRACT

Moderate-intensity aerobic endurance exercise performed regularly is known to prevent the development of metabolic and cardiovascular diseases. However, there is increasing evidence suggesting that intensive training and repeatedly performed extenuating performances can increase the incidence of sudden cardiac death (SCD) and other serious cardiac problems. This short article summarizes recent findings that support the idea that long-term endurance exercise training should either be done over shorter distances (e.g., 10K or half-marathons) or under close medical surveillance.

KEYWORDS

Marathon; Cardiac arrest; Calcium plaque; Atherosclerosis; Inflammation; Overtraining

LETTER TO EDITOR

A sedentary lifestyle i.e., walking less than 30 minutes per day, mobility impairment, physical inactivity, and paralysis are conditions known to increase the incidence of obesity, insulin resistance, hypertension, cholesterol, incidence of type II diabetes, and other cardiovascular problems [1-3].

On the other hand, long-term or excessive endurance exercise can impair the cardiovascular systems. Indeed, about eight hundred classical marathons i.e., 42 km races are performed each year by recreational athletes around the world. Extreme competitions such as ultra-marathons, triathlons, and ultra-triathlons are also increasingly popular. Although, it is generally believed that long-distance runners are not particularly at risks for cardiovascular problems [4], sudden cardiac deaths (SCD) and other life-threatening complications are increasingly found e.g., hyponatremia (sodium level lower than 130 mmol/L), cerebral edema, neurologic disability, etc. [5].

SCD is generally defined as a non-traumatic, non-violent, unexpected cardiac arrest within six hours of previously witnessed normal health. Recent data revealed that SCD affected 135 people among 9 million endurance athletes since the 1990s [6]. The victims were mainly male between 40 years and 50 years of age on average. Most cases occurred during the swimming portion of triathlons and ultra-triathlons. Several experts have indicated that these numbers may be an underestimation of the reality since only data from finishers were used [6].

Citation: Pierre A. Guertin, Sudden Cardiac Death and Other Life-Threatening Cardiovascular Problems Associated with Excessive Endurance Training. J Heart 2(1): 12-15.

In general, according to estimates from most other epidemiologic studies, about one of every 100,000 marathon runners experience SCD, but the incidence almost doubles to about one of every 57,000 participants during a race - in most cases SCD occurs in the last 6 kilometers of the race [7].

In a study published recently, researchers reported signs suggesting that full marathons may strain the heart. Biomarkers of cardiovascular stress - e.g., myoglobin concentration, self-reported muscle pain, body mass reduction, electrolyte imbalances, etc., were shown to be higher in marathoners than in athletes who did shorter distances such as half-marathons or 10 Ks [8].

Blood analyses of marathoners less than 24 hours after finishing a race were found to exhibit abnormally high levels of inflammatory and clotting factors (e.g., creatine kinase-MB, B-type natriuretic peptide) generally known to be associated with heart attacks [9].

According to Dr. McCullough, chief of cardiovascular research at the Baylor Heart and Vascular Institute, three hours or more of high volume cardiac overload such as during a long distance race, the right atrium and right ventricle are found to undergo abnormal dilatation which, in turn, is associated with temporary impaired chambers due to blood troponins and B-type natriuretic peptide increase.

After a 140-days cross-country race, it has been found that c-reactive protein (CRP) - biomarkers of inflammation -, significantly increased among runners during the study period whereas, in some of them, calcium plaque build-up significantly increased between the start and end of the race (American College of Cardiology July 28, 2017). This is also supported by a study published in 2019 reporting a significantly higher rate of coronary artery calcification in long-term marathon, ultramarathon, and extreme runners than in submarathon runners [10]. The prevalence of carotid and peripheral atherosclerosis in marathon runners is therefore both high and related to chronic cardiovascular risk factors as recognized earlier by German researchers [11].

Highly trained individuals undergoing frequent strenuous exercise could develop a pro-inflammatory condition that favors the onset of a number of health problems, including damage to myocardial cells and connective tissues, overload of the atria and right ventricle, coronary artery disease (CAD), and coronary artery calcification among other chronic health problems [12]. Other cardiovascular problems associated with long-distance exercising include unheralded ventricular arrhythmias, myocardial fibrosis, and late gadolinium enhancement. Veteran endurance athletes have been reported to have a 5-fold increase in the prevalence of atrial fibrillation whereas chronic excessive sustained exercise has been shown to cause patchy myocardial fibrosis [13].

Evidence from spinal cord injury research suggests that minimal amount of aerobic exercising can already trigger health benefits. Indeed, in people suffering from physical inactivity or partial paralysis, specific medical devices used alone or with body-weight-supported treadmill training during 30 minutes or 60 minutes a day were shown to produce detectable cardiovascular and metabolic health benefits [14,15]. This said, in completely paralyzed subjects, more complex combinatorial approaches including drugs and medical devices are apparently needed for cardiovascular, musculoskeletal, and metabolic benefits to be induced [16-22].

Along this idea, a very large study found in fact that in sedentary individuals, even a modest dose of physical activity, as little as 15 minutes per day, confers significant health benefits that increase in a dose-dependent fashion up to about an hour per day of vigorous physical activity, beyond which more exercise training does not yield

additional benefits [13]. For best cardiovascular and respiratory function improvements, it has clearly been shown that interval training (e.g., high-intensity interval training composed of 8 series of 30 seconds on at 90% of maximal heart rate, 30 seconds off or at low-intensity) rather than long distance training elicits superior effects [23] as suggested originally by Australian researchers [22].

CONCLUSION

In disabled and able-bodied persons, exercising daily more than 15 minutes or 30 minutes per day (pending upon intensity levels), 5 days a week is generally recognized as the threshold level for maintaining significant cardiovascular, respiratory, immune, and metabolic functions. However, athletes undergoing long-term endurance training such as marathons, ultra-marathons, and other comparable events, are generally at the risk of developing life-threatening acute or chronic cardiovascular problems. While exercise is one of the best ways to protect chronically against cardiovascular diseases, concerns are increasingly being raised by experts and scientists about the net beneficial outcome of extreme endurance exercise levels on the heart. Indeed, a safe upper-level limit probably exists, beyond which the adverse effects of long distance endurance training may out weight its cardiovascular benefits.

REFERENCES

1. Bauman WA, Spungen AM, Adkins RH, et al. (1999) Metabolic and endocrine changes in persons aging with spinal cord injury. Assistive Technology 11(2): 88-96.
2. Bauman WA, Spungen MD (2000) Metabolic changes in persons after spinal cord injury. Physical Medicine and Rehabilitation Clinics of North America 11(1): 109-140.
3. Battalio SL, Glette m, Alschuler KN, et al. (2018) Anxiety, depression, and function in individuals with chronic physical conditions: A longitudinal analysis. Rehabilitation Psychology 63(4): 532-541.
4. Maron BJ, Shirani J, Poliac LC et al. (1996) Sudden death in young competitive athletes: Clinical, demographic, and pathological profiles. JAMA 276: 199-204.
5. Sanchez T, Lamela L, Valdes R, et al. (2006) Evaluation of the productive indicators of Holstein cows in pedestals. Pastos y Forrajes 29(1): 51-60.
6. Harris KM, Creswell LL, Haas TS et al. (2017) Death and cardiac arrest in US triathlon participants, 1985 to 2016: A case series. Annals of Internal Medicine 167: 529-535.
7. Webner D, DuPrey KM, Drezner JA, et al. (2012) Sudden cardiac arrest and death in United States marathons. Medicine & Science in Sports & Exercise 44(10): 1843-1845.
8. Del Coso J, Salinera JJ, Lara B, et al. (2017) A comparison of the physiological demands imposed by competing in a half-marathon *vs.* a marathon. The Journal of Sports Medicine and Physical Fitness 57(11): 1399-1406.
9. Siegel AJ, Stec JJ, Lipinska I, et al. (2001) Effects of marathon running on inflammatory and hemostatic markers. The American Journal of Cardiology 88: 918-920.
10. Jafar O, Friedman J, Bogdanowicz I, et al. (2019) Assessment of coronary atherosclerosis using calcium scores in short- and long-distance runners. Mayo Clinic proceedings. Innovations, quality & outcomes 3: 116-121.
11. Kröger K, Lehmann N, Rappaport L, et al. (2011) Carotid and peripheral atherosclerosis in male marathon runners. Medicine and Science in Sports and Exercise 43: 1142-1147.

12. Barros ES, Nascimento DC, Prestes J, et al. (2017) Acute and chronic effects of endurance running on inflammatory markers: A systematic review. Frontiers in Physiology 8: 779.
13. O'Keefe, Patil HR, Lavie CJ, et al. (2012) Potential adverse cardiovascular effects from excessive endurance exercise. Mayo Clinic. Proceedings of the Staff Meetings of the Mayo Clinic 87(6): 587-595.
14. Ditor DS, Macdonald MJ, Kamath MV, et al. (2005) The effects of BWSTT on cardiovascular regulation in individuals with motor-complete SCI. Spinal cord 43: 664-673.
15. van Duijnhoven N, Hesse E, Janssen T, et al. (2008) Impact of exercise training on oxidative stress in individuals with a SCI. European journal of Applied Physiology 109(6): 1059-1066.
16. Guertin PA, Ung RV, Rouleau P, et al. (2011) Effects on locomotion, muscle, bone and blood induced by a combination therapy eliciting weight-bearing stepping in non-assisted Tx mice. Neurorehabilitation and Neural Repair 25.
17. Gerasimenko Y, Gorodnichev R, Puhov A, et al. (2015) Initiation and modulation of locomotor circuitry output with multisite transcutaneous electrical stimulation of the spinal cord in non-injured humans. Journal of Neurophysiology 113(3): 834-842.
18. Radhakrishna M, Steuer I, Prince F, et al. (2017) Double-blind, placebo-controlled, randomized phase I/IIa study (safety and efficacy) with buspirone/levodopa/carbidopa (Spinalon) in subjects with complete AIS A or motor-complete AIS B spinal cord injury. Current Pharmaceutical Design 23(12): 96-105.
19. Freyvert Y, Au Yong N, Morikawa E, et al. (2018) Engaging cervical spinal circuitry with non-invasive spinal stimulation and buspirone to restore hand function in chronic motor complete patients. Scientific Reports 8(1): 15546.
20. Krassioukov AV, Currie KD, Hubli M, et al. (2019) Effects of exercise interventions on cardiovascular health in individuals with chronic, motor complete SCI: Protocol for a randomized controlled trial. BMJ Open 9: e023540.
21. https://trialbulletin.com/lib/entry/ct-02936453
22. Wenger HA, Bell GJ (1986) The interactions of intensity, frequency, and duration of exercise training in altering cardiorespiratory fitness. Sports Medicine 3: 346-356.
23. Helgerud J, Hoydal K, Wang E, et al. (2007) Aerobic high-intensity intervals improve VO_2 max more than moderate training. Medicine and Science in Sports and Exercise 39: 665-671.