

SPORTS CARDIOLOGY  
PART III

# The Athletes' Heart: Bigger & Stronger, but is it Safer?

In this edition, I will focus on one of the most controversial topics in sports cardiology - whether the heart changes brought about by heavy training may cause rhythm disturbances.

**HAVE A QUESTION ON ANY HEART RELATED TOPIC?**

If you have a question for Dr Andre La Gerche on any heart related topic he can be reached via our Runners Soapbox (email [soapbox@runforyourlife.com.au](mailto:soapbox@runforyourlife.com.au)). Dr Andre will endeavour to answer as many questions as possible in an upcoming edition of R4YL.

**S**O FAR in the series of articles I have described the enormous benefits of regular exercise in moderate doses. In the second issue I discussed the rare genetic causes that may lead to collapse or death. It is worth summarising briefly as the message is important. The risks of exercise are extremely small. They are further minimised by getting into exercise in a gradual, progressive fashion. If there are any symptoms of chest pain, breathlessness or dizziness then medical attention should be sought. The benefits of exercise far outweigh the risks if this simple advice is followed.

**What is athletes' heart?**

When you exercise, the heart (like all muscles in the body) adapts to the load placed upon it. The body asks for more oxygen and the heart responds by increasing the amount of blood supply which carries the oxygen. Blood supply or cardiac output (CO) is calculated by the Stroke Volume (SV), i.e. the amount of blood that the heart can pump with every beat times the heart rate (HR). Therefore:  $CO = HR \times SV$

The body wants as much CO as possible during intense exercise so the HR and SV both increase. The SV increases by means of the heart pumping more forcefully. With time and repeated exercise, SV also increases as a result of heart dilatation. That is, the heart gets bigger so that it can pump more blood with every beat.

There are three things that largely define how big the heart gets in response to athletic training: **AMOUNT OF TRAINING.** It has been dem-

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onstrated that athletes' hearts can develop with 3 or more hours of athletic training per week. The extent of heart dilatation increases with the amount of training practised<sup>[1]</sup>.

**TYPE OF TRAINING.** Whilst all physical training results in heart enlargement, different types of training have differing effects. Power based sports (eg sprinting) result in heart muscle thickening and only slight heart dilatation. Endurance sports such as marathon running result in dilatation and little thickening. Sports such as cycling, triathlon and rowing which combine endurance and power result in the largest hearts of all<sup>[2]</sup>.

**» There is no evidence that competitive athletes are more likely to develop serious arrhythmias or die suddenly. »**

**GENETICS.** Genes have been identified which dictate the amount of thickening and dilatation that occurs. This is an evolving science. What is clear, however, is that we see athletes who exercise similar amounts and have very big differences in the extent to which the heart has adapted. There is no clear link between how much the heart adapts and how well the athlete performs.

**An athletes' heart is able to pump more, but are there any disadvantages?**

This is an area of much speculation and controversy. There are a number of conditions which result in heart enlargement which are bad for health. For example, high blood pressure can result in heart muscle thickening. Diseases which make the heart muscle weak often result in heart dilatation. In these and other conditions, heart enlargement is a very serious sign which can lead to breathing problems or serious rhythm problems. As a result, there has been much concern that the changes seen in athletes' hearts may lead to long-term problems and perhaps even an increase in the risk of sudden death.

There is no evidence that competitive athletes are more likely to develop serious arrhythmias or die suddenly. As explained in the last edition of R4YL, any slight excess in sudden death in athletes is likely to be due to rare underlying heart problems rather than exercise itself<sup>[3]</sup>. It is worth re-stating that sudden death in young people is extremely rare in any healthy population (about 1 in 100,000). There has been very little research done on athletes who have been competing for many years or ex-athletes. That is, we have not answered the question as to what the longer term impact of heart enlargement is in athletes. One recent study perhaps gives some indication. A group of 62 former professional cyclists was compared to an age-matched group of golfers<sup>[4]</sup>. Their average age was 66 years and, 40 years after retirement, their hearts were still larger than the golfers on average. The former athletes were more likely to have heart arrhythmias. These were mostly common "nuisance" type arrhythmias rather than serious ones.

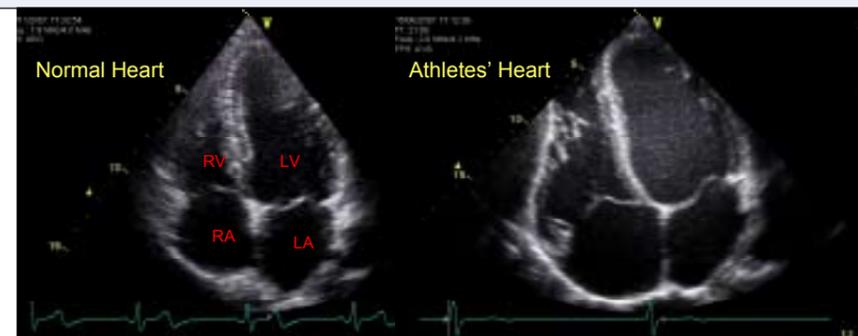


Figure: A normal heart (left) as compared with that of a 23 year old professional cyclist (right). All four cardiac chambers are enlarged. Blood from the body comes into the right atrium (RA) and into the right ventricle (RV) which pumps blood through the lungs. Blood then flows into the left atrium (LA) and then the left ventricle (LV) pumps it around the body. The normal heart expels 60ml with every beat and the cyclist pumps 150ml.

**» The good and the bad arrhythmias**

There are not really any good arrhythmias but there are a number that do not lead to serious problems or death. These arrhythmias are far more common than the serious type. I will discuss three types: ectopics, atrial fibrillation and ventricular tachycardia. In this order they go from very common and completely safe through to rare and potentially life threatening.

**ECTOPICS.** These are extra heart beats that may be felt as sudden as pauses, jumping beats or forceful beats of the heart. They are extremely common, occurring in about 10% of the population. In otherwise healthy people they are completely safe. The best treatment is usually reassurance as medications often have side effects worse than the condition itself. There is some evidence that ectopics are more common in athletes and that reducing training may decrease the amount of ectopics<sup>[5]</sup>. This probably only needs to be considered if they are causing significant symptoms as they are not a health risk.

**ATRIAL FIBRILLATION (AF).** This is a fairly common rhythm problem which results in an irregular and often fast heart rate. Whilst some people can be unaware of it, young people often feel quite rotten if they develop it. It is not a pleasant problem but is relatively safe and does not bring about more serious rhythm problems. AF is probably slightly more common in athletes. Though some would debate this, there are a number of quite well conducted studies which suggest that there is about a 2 - 5 times greater risk in athletes<sup>[6,7]</sup>. It is still uncommon, occurring in only a few percent of older athletes.

**VENTRICULAR TACHYCARDIA (VT).** This is a serious but rare arrhythmia which can lead to sudden death. A few of Australia's greatest triathletes (Greg Welch, Emma Carney and Bruce Thomas) have been diagnosed with this condition leading to speculation that it was sport that caused it. Whilst this possibility needs to be investigated, there is no clear proof that this is the case. The treatment for VT is usually to perform a small operation to implant a specialised "defibrillator" which gives the heart a small shock if VT develops, thus restoring normal rhythm. Those who have required such treatment know that it is far from a perfect solution but it certainly saves lives.

**Summary**

In summary, intense athletic training can result in very definite changes in the heart's shape and function. This enables it to pump greater amounts of blood enabling more intense exercise. It is possible that the resulting enlarged heart may slightly increase the risk of heart rhythm problems - most of which are not serious. There is still much to be learnt, however, and clearly more research is required to understand the process so that serious arrhythmias can be prevented.

Any slight risk needs to be balanced against the enormous health, mental and social benefits of exercise. I am certainly planning to continue running!

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Emma Carney (R) competes with Susan Michelsson in the Sussan 10km. Champion triathletes Carney and Greg Welch have developed Ventricular Tachycardia but there is no clear proof it was caused by their involvement in sport. GETTY IMAGES

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