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WORLDWIDE DOMINATION

Building muscles shouldn't break hearts

Understanding the cardiotoxicity of steroids with advanced techniques in echocardiography

When it comes to anabolic steroids, there's one muscle that needs more attention: the heart. Prolonged steroid use has been linked to devastating cardiovascular effects.[1] With steroid use on the rise,[2] it's more important than ever to understand the effects on heart morphology and mechanics. Some of those critical answers can be found in the echo lab. However, we must delve into the details and, most importantly, incorporate advanced techniques into our analysis.

Anabolic steroids are synthetic derivatives of testosterone that are commonly used to enhance athletic performance, muscle development, and aesthetics. In sports circles, the use of performance-enhancing substances has been a contentious issue and widely debated. While steroids are commonly associated with professional sports, they are increasingly prevalent in high school locker rooms, neighborhood gyms, and fitness centers. In fact, an estimated tens of millions of people worldwide are taking steroids, and most are not competitive athletes.[3,4,5] The lifetime prevalence of ever using steroids in men (in the general population) is approximately 1% to 5%.[2,6]

Sports cardiologist Dr. João Giffoni has seen an uptick of these patients in his practice at Ipanema Health Club in Brazil. In his role as coordinator of the Advanced Imaging Center, Dr. Giffoni has conducted research on a range of steroid-induced cardiovascular complications, gaining valuable insights with advanced techniques in echocardiography. In total, his institution performs approximately 400 echocardiography exams every month, including advanced analyses (strain, myocardial work, 3D transthoracic echocardiography), vascular Doppler, cardiopulmonary exercise testing, and isometric and isotonic physical stress echocardiography.

We recently asked Dr. Giffoni to share his views on the cardiotoxicity of steroids and why he believes strain imaging and myocardial work are vital in diagnostics.

What made you want to pursue sports cardiology?

Dr. Giffoni: *I'm an athlete who enjoys sports and I have been involved in physical activities for most of my life. I've also consistently sought knowledge related to the cardiovascular performance of athletes and have an interest in assisting athletes with their performance.*

Can you describe your patient population?

Dr. Giffoni: *Our patients include regular and high-performance athletes, as well as sedentary individuals seeking longevity and beginning physical activities. We also see patients with coronary diseases or cardiomyopathies that are looking for safe exercise guidelines within their cardiac limits. For these patients, the presence of pathologies leads them to seek medical guidance, and it's our job to help them achieve high cardiovascular performance. Our role is to use cardiovascular analysis technology for the early detection and treatment of pathological conditions. For athletes, this allows for better performance. For the general population, it results in improved health and longevity.*

With current changes in sports medicine and the increasing prescription of steroid hormones, we are now facing a new condition. Patients are developing cardiac functional changes due to the use of anabolic steroids and other stimulating substances. Patients frequently use these substances in pursuit of a 'perfect body' and enhanced performance.

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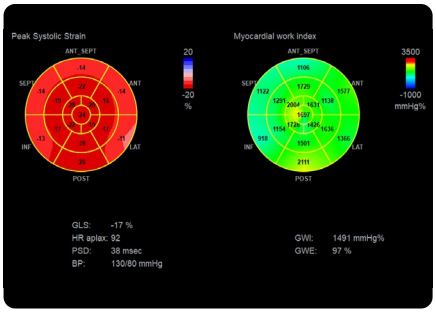

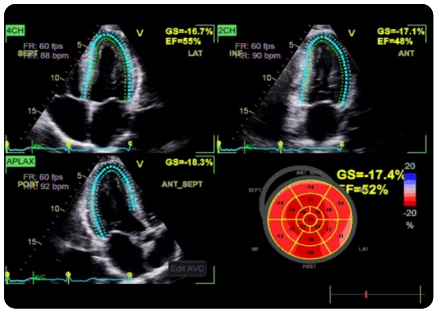

Research shows steroid use is widespread and increasing. What are some of the factors contributing to the rise in numbers?

Dr. Giffoni: *There has been a rapid growth in fitness and bodybuilding culture. There is a positive side, including training, discipline, and healthier eating habits. However, there is also a dark side to the indiscriminate use of steroids—all of which is amplified by the media.*[6]

Currently, the use of steroids has become common. In today's culture, there is a certain glamour associated with their use. This is especially true here in Brazil,[7] *but I believe it's the same for Europe and the United States.*

Statistically, in the last decade, there has been an exponential increase in steroid use associated with increased prescriptions by doctors. The main reason is the relentless pursuit of a perfect physique. Notably, steroid use has expanded beyond the realm of high-performance sports, entering gyms and the offices of integrative medicine, endocrinology, and sports medicine.

Steroids have become a cornerstone of various medical treatments for libido, sarcopenia, obesity, osteoporosis, and primary and secondary hypogonadism, as well as for aesthetic purposes.

How do anabolic steroids impact cardiac function?

Dr. Giffoni: *We know anabolic steroids harm the heart muscle through direct aggression. There are two main mechanisms: genomic and non-genomic pathways. Both have been studied extensively in the literature. These mechanisms cause direct aggression to cardiomyocytes, leading to myocardial dysfunction, changes in the contractile pattern, increased left ventricular mass, and alterations in ventricular relaxation.*[1,8]

The use of anabolic steroids opens a new scenario as it increases the prevalence of adverse cardiovascular conditions such as hypertension, coagulation disorders, and changes in lipid profiles. These situations need to be analyzed as additional risk factors.

Why is echocardiography so important in sports cardiology?

Dr. Giffoni: *Echocardiography is fundamental in sports because it allows us to evaluate the presence of pathological conditions potentially associated with cardiovascular events that could be exacerbated by physical activity. Using echocardiographic techniques like strain and myocardial work, we can differentiate between cardiac adaptations to physical training and significant pathological conditions, such as Hypertrophic Cardiomyopathy (HCM). This reduces the so-called gray zone.*

In my practice, we use advanced tools daily. Not only for faster information that facilitates interpretation, but also for providing greater diagnostic possibilities. Most importantly, these tools help us better understand cardiac mechanics.

Through education, we have already managed to plant the seed of change in the national scenario where sports doctors now understand cardiotoxicity in a different way. They understand the need to perform echocardiograms with advanced techniques—introducing the use of myocardial work, in addition to isometric stress tests. Until recently, this was unthinkable.

> *"Without the use of advanced echocardiographic technology and stress analysis, it is highly likely that conventional echocardiographic evaluations will appear normal, leading to a loss of diagnostic time."*

What is the value of strain imaging in evaluating the impact of steroids on the heart?

Dr. Giffoni: *Depending on cardiac changes, patients will present with alterations in longitudinal strain, left ventricular twisting, and left atrial function. Without the use of advanced echocardiographic technology and*

stress analysis, it is highly likely that conventional echocardiographic evaluations will appear normal, leading to a loss of diagnostic time. That is why the use of strain imaging becomes mandatory in this group of patients. Additionally, there are alterations in myocardial work, with an increase in wasted work and a loss of efficiency.

Do you see any benefit of using RV and/or LA strain in addition to LV strain in athletes?

Dr. Giffoni: *Yes, both RV and LA strain are key for different reasons. We cannot consider the left ventricle without associating it with left atrial function. Proper ventricular function depends on good ventricular filling, which involves atrial function. When we talk about athletes, we refer to cardiopulmonary capacity. In this sense, we already know that the longitudinal strain of the right ventricle is closely related to cardiopulmonary capacity.*

For example, a right ventricular strain of less than 15% indicates significantly reduced cardiopulmonary capacity in anabolic steroid users.[8]

> *"Saving time is very helpful, especially in daily routines. However, reproducibility is essential because a technique must be reproducible to be used on a larger scale."*

How is strain helpful in other aspects of sports cardiology?

Dr. Giffoni: *I have incorporated strain into my clinical practice since 2009. From the beginning, I understood that it enables earlier diagnoses. We have observed significant technological advancements over time, allowing us to expand our capabilities beyond diagnostics.*

When studying the athlete's heart, we can now develop projects with sports trainers on cardiovascular performance, helping fine-tune the cardiac machine. That means understanding the right balance between contraction and relaxation, understanding contractility, the twisting mechanism, and how this impacts myocardial work, which influences cardiac efficiency.

For athletes and sports enthusiasts, details make a huge difference. These details can only be seen with the use of all the variables that echocardiographic tools like strain and myocardial work allow.

You utilize Easy AFI and Auto EF in your practice. What is the value of artificial intelligence in echocardiography?

Dr. Giffoni: *Saving time is very helpful, especially in daily routines. However, reproducibility is essential because a technique must be reproducible to be used on a larger scale. I particularly notice this when using Easy AFI and Auto EF. Looking forward, I believe that artificial intelligence will soon assist in defining important diagnostic patterns and conditions associated with specific clinical conditions, predicting the development of specific pathological phenotypes.*

What are some of the current gaps in sports cardiology and where could innovation make an impact?

Dr. Giffoni: *Sports cardiology is a rapidly growing field that is gaining attention as clinical cardiologists recognize the need to understand these patients differently. In this scenario, I see an increasing need for technology to understand the functional changes occurring in our patients' bodies (athletes or high-performance athletes,*

especially those using anabolic steroids), particularly in the cardiovascular system. This includes understanding the changes brought about by physical training and the effects on patients who resort to new medical therapies in the relentless pursuit of beauty and youth.

What steps are you taking to advance the field and help others understand the effects of steroids on the heart?

Dr. Giffoni: *We have been studying and researching the use of steroid hormones and their interaction with the cardiovascular system for several years, presenting our findings at national and international conferences. We are also participating in podcasts and educating doctors in various courses and lectures throughout Brazil. We are currently part of the faculty of the first postgraduate course in sports cardiology in Brasil, coordinated by Dr. Renata Castro. Additionally, we are pioneers in sports echocardiography with a course held at ECOPE, the School of Echocardiography in Pernambuco.*

We are contributing to a book set to be released later in 2024, focusing on cardiac strain. In this book, we discuss the cardiotoxicity of steroid use and the application of myocardial work. This panorama reflects immense growth in the country. I believe that the technology of myocardial work is now being used extensively by all our students, mainly because of the cardiotoxicity caused by steroid use.

How are you trying to educate the public on the dangers of anabolic steroids?

Dr. Giffoni: *We work daily to try to raise awareness among people on social media. I also think we should have more presence at fitness fairs. We need to do more to reach the primary audience, which is influential and generates a lot of content on social media. This sparks debate and drives doctors to seek out the content inversely. In other words, the public brings the information to doctors who feel the need to stay informed.* ■

Dr. João Giffoni is the coordinator of the Advanced Imaging Center at Ipanema Health Club. He specializes in sports medicine, cardiology, and echocardiography. The sports cardiologist combines academic research with clinical practice, investigating the impact of steroids on athletes' hearts. Dr. Giffoni has published articles and various papers at congresses in Brazil, the American College, and ESC on the subject. He also shares a passion for sports, including bodybuilding, boxing and jiu-jitsu.

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