Sudden Cardiac Death in Pro Cycling

In the wake of 23-In the wake of 23-year-old Michael Goolaerts' tragic death during the recent edition of Paris-Roubaix, the general topic of sudden cardiac death is suddenly on the minds of a lot of cycling fans – and probably more than a few professional riders as well. Although extremely rare, when an event like this does happen, it generates intense media attention and coverage – and can lead to anxiety, worries and misinformation. Below, we try to put this issue into clearer scientific context.

Sudden cardiac death (SCD) is extremely uncommon in young people, and is estimated to occur in only between 1 in 40,000 to 1 in 80,000 young athletes. Unfortunately, Goolaerts' death illustrates how misconceptions can develop when the popular media tries to cover complex medical issues with incomplete data. Video footage of Goolaert's crash is limited, but individual fan smartphone videos posted on social media after the race show that roadside CPR was clearly administered to the unconscious victim. It was later reported that Goolaerts died of cardiac difficulties during or following aeromedical transport to Lille.

To many who saw the video, CPR implied that the victim was suffering a "heart attack." Subsequent press reports incorrectly used the terms "heart attack" and "cardiac arrest" interchangeably, adding to confusion. This confusion was further compounded when Goolaerts' preliminary autopsy results were released by the Cambrai State Prosecutor, Remy Schwartz who said, "death was due to a heart attack and not a crash. He suffered an attack while racing. His heart stopped, and that is why he crashed". Are these important differences or are they mere subtleties, and what are the implications for cyclists?

A **heart attack**, or myocardial infarction, is an acute rupture of a cholesterol plaque within a coronary artery that results in a sudden blockage of blood flow. If uncorrected, the heart muscle supplied by the artery will be permanently damaged (scarred). Typical treatment for a heart attack is the insertion of a coronary stent, to allow the blood flow to be reestablished. The underlying cause of heart attacks – coronary artery disease – is an acquired condition, and is more prevalent in older patients and those with underlying risk factors (high blood pressure, high cholesterol, diabetes, smoking history and so on). Heart attacks are exceedingly rare in otherwise healthy individuals below 35 years of age, and epidemiologically would be a highly unlikely cause of SCD in a young, elite athlete.

Cardiac arrest, on the other hand, is an abrupt, unexpected loss of heart function. In otherwise healthy people or athletes, lethal cardiac arrhythmias are the most likely causal factors. These arrhythmias are electrical events which originate in the bottom chambers of the heart, resulting in rapid and chaotic heart rates. If not corrected promptly, death can result within minutes. CPR and automated defibrillators may be lifesaving. Heart attacks are often mistakenly confused with cardiac arrest, as may have been in the case of Michael Goolaerts. But as a rule, the heart does not just abruptly stop beating in an otherwise healthy young person.

Although a cardiac arrest can be caused by a heart attack, there are other problems or preexisting conditions that can also result in cardiac arrest. Unfortunately, SCD may itself be the first "symptom" of significant underlying heart disease in an apparently and otherwise healthy, young athlete. In other words, the condition may be totally unknown until it is too late. In fact, only 30% of victims report any prodromal symptoms (early signs of a condition) prior to their cardiac arrest – chest pain, shortness of breath, palpitations or passing out.
In younger and healthier patients, two specific inherited conditions are the predominant cause of SCD – hypertrophic cardiomyopathy and anomalous coronary artery origin. Hypertrophic cardiomyopathy is genetically inherited and results in abnormal thickening of the heart muscle, potentially leading to cardiac arrest from lethal ventricular arrhythmias. Anomalous coronary artery origin can result in insufficient cardiac blood flow during exercise – but is typically not related to the more common coronary artery disease described above.

Additional possible causes for SCD in young athletes include primary heart rhythm disorders in otherwise normal hearts (sometimes called channelopathies) or other structural problems like Arrhythmogenic Right Ventricular Cardiomyopathy (ARVC). ARVC is a genetic defect that is disproportionately more common in males of Mediterranean descent, in which fatty replacement of the right ventricular cardiac muscle can also lead to potentially lethal ventricular arrhythmias. Some of these inherited conditions may go completely undetected even if the person is subjected to sophisticated screening.

Goolaert's shocking death has understandably led some to question the safety of elite-level cycling and, more critically, the efficacy of pre-competition screening protocols. However, in a 2016 study published in the International Journal of Cardiology, Santos-Lozano, et al. reviewed 98 documented deaths in the entire history of professional cycling. Perhaps most famous in the annals of cycling was the death of 29-year-old Tommy Simpson on the slopes of Mont Ventoux in 1967, on a day when temperatures reportedly reached 110 degrees Fahrenheit. As is well-known now, Simpson’s cause of death was complicated by the fact that his body was also chock full of amphetamines and alcohol. But five other pro cyclists have also died of cardiac-related causes in just the last twelve years, two of which definitely met the criteria for SCD.

After accounting for all cycling events and the multitude of participants, this study showed that cycling actually had a lower incidence of SCD than other sports. Furthermore, their data found no relationship even at the highest levels of competition – between strenuous endurance exercise and SCD – as long as the cyclists had a solid training base and no previous cardiac problems. Incidentally, this epidemiologic study also noted that former Tour de France participants exhibited a 43% lower risk of cardiovascular mortality than the general population.

The most important question here is what can pro cycling do to monitor and minimize the incidence of SCD in the sport? Pre-participation screening can indeed help identify athletes at risk of SCD. The American College of Cardiology (ACC) suggests a physical exam and targeted medical history comprising athlete symptoms, family history of heart problems, and any family history of SCD. Although still a topic of debate within the ACC, the European Society of Cardiology (ESC) and the International Olympic Committee (IOC) fully endorse an electrocardiogram (EKG, more commonly referred to as an ECG in Europe) for all athletes – to screen for pre-existing heart diseases or conditions. All three of these groups agree that any detected abnormalities should be investigated by echocardiography (ultrasound analytical diagnosis of the heart). These results should then be referred to a licensed cardiologist who is familiar with normal cardiovascular adaptations to training, because such changes can often be confused with diseases or disorders by inexperienced clinicians.

The UCI has been proactive in terms of testing, and in addition to a yearly “cardiological questionnaire” and ECG, also requires biannual echocardiograms and ECG stress tests. The ultimate responsibility for specialist referrals, however, rests on the individual rider and his team physician. In the United States, the current focus of pre-participation screening is to effectively screen school-aged children first engaging in physical activities, and to monitor higher-level professional athletes. Masters athletes, who often compete outside an organized team structure, present a worrisome challenge – not only because they generally lack access to formal screening programs, but also because they may be at higher risk due to long term, undiagnosed coronary artery disease.
In summary, it appears that most of the relevant governing agencies are doing a reasonable job in trying to screen and test athletes for these extremely rare conditions. But even one death from unknown or undetected pre-existing heart conditions is one too many, and so it is incumbent upon athletic organizations like the UCI to stay at the cutting-edge of medical monitoring and testing technology in this regard.

It seems clear enough that Michael Goolaerts suffered a cardiac arrest, but it will likely be weeks before the pathology and toxicology testing is complete, when we may have a better idea of what actually led to

his death. Until then, we should be careful to avoid making any generalized assumptions regarding the mechanism or the actual cause of his death. And perhaps most importantly, we should utilize this tragedy as a motivation to ensure that athlete screening and testing is as thorough as possible, and to regularly assess our own cardiac risk.

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