Implantable Cardioverter Defibrillator (ICD) and competitive cycling

Recommendations of the UCI Medical Commission

Athletes can present with symptoms such as syncope or cardiac arrest, leading to a diagnosis of cardiovascular disease, or can be diagnosed through screening examinations, either specific pre-participation evaluation (PPE) or routine family screening (1).

After the diagnosis, implantable cardioverter-defibrillators (ICDs) may be recommended, either for secondary prevention or for primary prevention following standard disease-specific risk assessment for sudden cardiac death. While this question was controversial for many years, both European (Figure 1) and USA (Figure 2) consensus statements generally restricted patients with ICDs to participation in competitive sports, even if USA guidelines seem to be a little more permissive. Therefore, the question of the safety of return to play for these athletes is a discussing question, since the restriction from sport can significantly decrease their quality of life (2).

Recommendations	Class[a]	Level[b]
It is recommended that individuals with implanted devices with/without resynchronization and underlying disease follow the recommendations pertaining to the underlying disease.[384,425]	I	B
Participation in sports and exercise (except collision sports) should be considered in individuals with pacemaker therapy who do not have pathological substrates for fatal arrhythmias.	IIa	C

Prevention of direct impact to the implanted device by adapting the site of lead and/or device implantation, padding, or restricting direct impact sports should be considered.	IIa	C
Holter recordings and device interrogation during and after resuming sports should be considered to allow appropriate tailoring of rate-responsive pacing parameters, exclusion of myopotential or electromagnetic inhibition, and detection of VAs.	IIa	C
Shared decision making should be considered during decisions relating to continuation of intensive or competitive sports participation in individuals with an ICD, taking into account the effect of sports on the underlying substrate, the fact that intensive sports will trigger more appropriate and inappropriate shocks, the psychological impact of shocks on the athlete/patient, and the potential risk for third parties.	IIa	C
An ICD is not recommended as a substitute for disease-related recommendations when these mandate sports restrictions.	III	C

Figure 1 – Recommendation for exercise in individual with pacemakers and implantable cardioverter defibrillator according to 2020 ESC Sports Cardiology and Exercise guidelines (3). ICD = implantable cardioverter defibrillator; VA = ventricular arrhythmia. [a]Class of recommendation. [b]Level of evidence.

Recommendations

1. **ICD indications for competitive athletes should not differ from those applicable to the general population with appropriate diagnoses and clinical profiles *(Class I; Level of Evidence C).***

2. **Recommendations should be based on existing evidence for benefit and risk and should include discussions of potential impact on sport-specific participation and performance *(Class I; Level of Evidence C)*.**
3. **Participation in sports classified as IA for athletes with an ICD is reasonable if they are free of episodes of ventricular flutter or ventricular fibrillation requiring device therapy for 3 months *(Class IIa; Level of Evidence C)*.**
4. **Participation in sports with higher peak static and dynamic components than class IA may be considered if the athlete is free of episodes of ventricular flutter or ventricular fibrillation requiring device therapy for 3 months. The decision regarding athletic participation should be made with consideration of, and counseling of, the athlete regarding the higher likelihood of appropriate and inappropriate shocks and the potential for device-related trauma in high-impact sports *(Class IIb; Level of Evidence C)*.**
5. **The desire of the athlete to continue athletic competition should not represent the primary indication for use of an ICD *(Class III; Level of Evidence C)*.**

Figure 2 – Recommendations for exercise in individual with pacemakers and implantable cardioverter defibrillator according to 2015 AHA guidelines (4)

Shared decision making is appropriate when deciding whether or not to continue sports and the level of participation with an ICD (3). Moreover, the athlete must be aware of the programmed detection rate cutoffs, in order to be able to avoid reaching those during exercise (5). Furthermore, given data showing similar efficacy and safety between sub-cutaneous ICD and transvenous device (6), one of the main criteria driving choice may be likelihood of injury to the lead or generator from the specific sport.

Even if a large multinational ICD Sports Safety Registry has shown that after a median follow-up of 44 months there were no deaths or arrhythmia or shock-related physical injury in 440

athletes who continued competition or high-risk sport after ICD implantation (7), there are three important considerations to make when considering sport eligibility in these subjects:

1. Carefully evaluate if sport is contraindicated because it can contribute to the progression of the underlying disease (such in case of arrhythmogenic cardiomyopathy (8)).
2. Consider that ICD shocks, even when appropriate and safe, will have a psychological impact on the athlete; this is worrying, considering that high intensity exercise is a triggering activity in appropriate and inappropriate shocks (9).
3. Do not forget that situation where loss of focus or loss of consciousness could cause harm to a third party or to the athlete themselves (such as cycling).

Therefore, there is a general agreement in considering the underlying pathology as one of the main determinants when evaluating the medical fitness of an athlete with ICD. In the specific case of professional cyclists, a very careful and restrictive approach is needed not only for the ICD, but mainly for the underlying arrhythmogenic cardiomyopathy.

Indeed, ICD in an athlete who experienced a cardiac arrest and who want to play an at-risk sport like cycling is a very dangerous condition that requires a strict medical management and that is not compatible with professional sport activity (Figure 3).

Recommendations	Class[a]	Level[b]
Exercise recommendations		
Participation in 150 min of low-intensity exercise per week should be considered for all individuals.	IIa	C
Participation in low- to moderate-intensity recreational exercise/sports, if desired, may be considered for individuals with no history of cardiac arrest/VA, unexplained syncope, minimal structural cardiac abnormalities, <500 PVCs/24 h and no evidence of exercise-induced complex VAs.	IIb	C
Participation in high-intensity recreational exercise/sports or any competitive sports is not recommended in individuals with ACM, including those who are gene positive but phenotype negative.[384,386]	III	B

Follow-up and further considerations relating to risk		
Annual follow-up is recommended for individuals who exercise on a regular basis.	I	C
Six-monthly follow-up should be considered in adolescent individuals and young adults who are more vulnerable to exercise-related SCD.	IIa	C
Annual assessment should be considered for genotype-positive/phenotype-negative individuals for phenotypic features and risk stratification purposes.	IIa	C
Six-monthly follow-up should also be considered in individuals with high arrhythmic risk genotypes such as DSP, TMEM43, and carriers of multiple pathogenic variants.	IIa	C

Figure 3 – Recommendation for exercise in individual with arrhythmogenic cardiomyopathy according to 2020 ESC guidelines (3). ACM = arrhythmogenic cardiomyopathy; PVC = premature ventricular contraction; SCD = sudden cardiac death; VA = ventricular arrhythmia. [a]Class of recommendation. [b]Level of evidence.

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