Quoi de neuf: en cardiologie du sport

Frédéric SCHNELL

CHU RENNES

Service de médecine du sport

UNIVERSITE de RENNES

LTSI – INSERM UMR 1099 & CIT-IT 1414

Conflits d’intérêts

Astra Zeneca
Canon medical
Amgen
Novartis
Boehringer
Medtronic
Sanofi

PLAN

Risque de la compétition ?

Etiologie des morts subites chez l'athlète ?

Remodelage du cœur d'athlète ?

Remodelage délétère en cas de cardiopathie ?

Intérêt du DSA ?

Risques /Bénéfices événements sportifs de masse

Étude Néerlandaise - événements sportifs de masse

Participants : 546 876, âge médian 41 ans, 🚹 56 %

Non-participants : 211 592, âge médian 41 ans, 🚹 67%

Décès enregistrés : 4625.

Risque de mortalité à court terme (0–7 jours) :

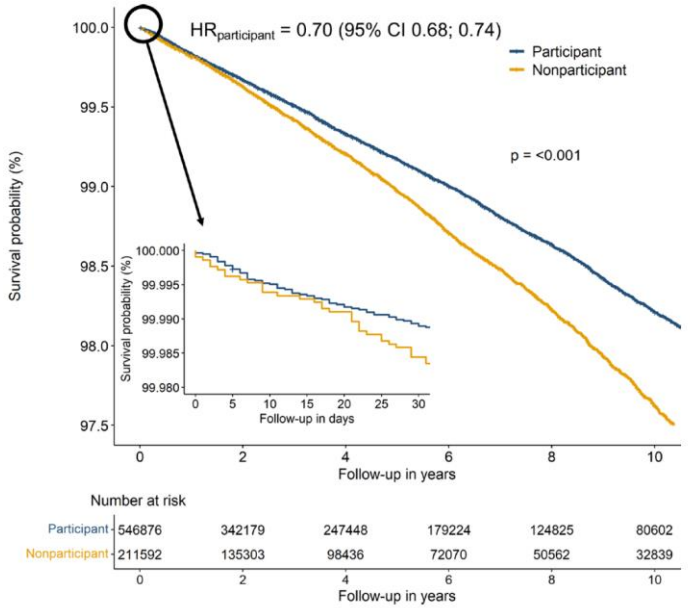
⬆ NS risque associé à l'exercice aigu (OR 1,92).

Taux absolu : 4,2 pour 100 000 participants

Risque de mortalité à long terme (suivi: 3,3 ans) :

Participants risque 30 % plus faible que les non-participants (HR 0,70) (ajusté sur âge et sexe).

Meilleurs taux de survie : Coureurs (HR 0,65), Cyclistes (HR 0,70), Marcheurs (HR 0,88).



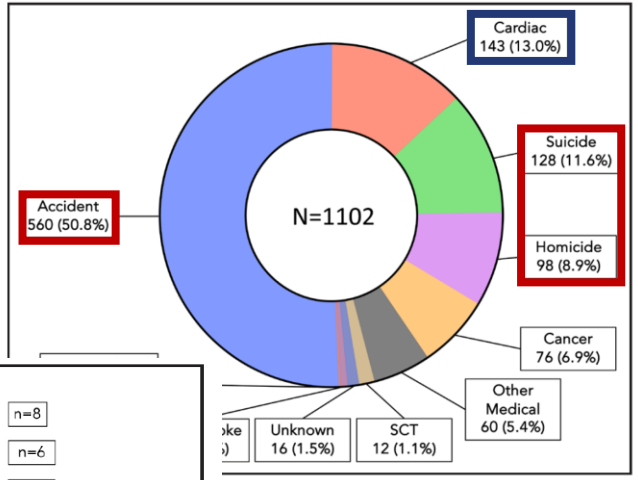
Bakker E, et al. All-cause mortality risks among participants in mass-participation sporting events. Br J Sports Med 2024

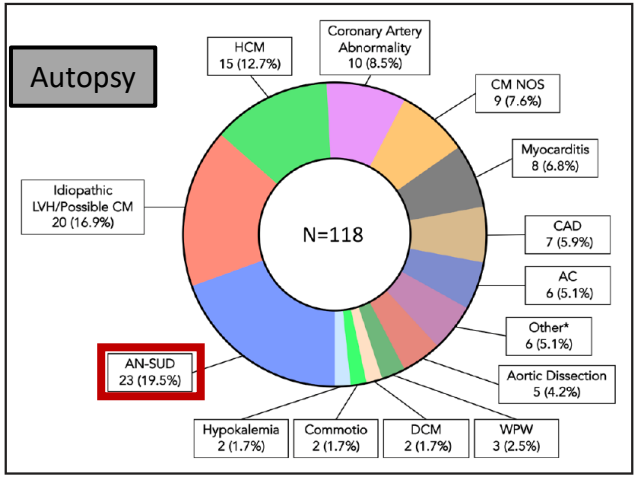
Etiologies des morts subites chez les jeunes athlètes

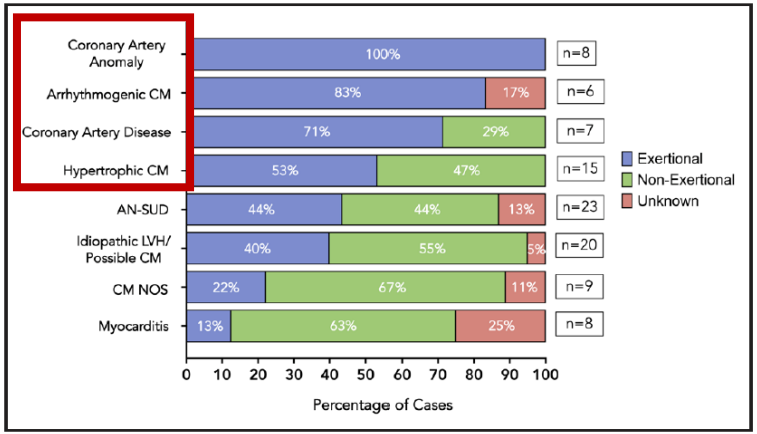
MS d'origine cardiaque = 1ere cause médicale de décès

Mort subite avec autopsie-négative = 1ere cause de décès CV

Nécessité de tests génétiques post-mortem ?
ECG aurait pu être anormal ?







Petek B, et al. Sudden cardiac death in national collegiate athletic association athletes: a 20-year study. Circ. 2023.

Intérêt de l'autopsie moléculaire chez l'athlète

Rôle diagnostique du test génétique post-mortem; n=42 (6%)

Variants pathogènes, probablement pathogènes ou variant de signification inconnue (VSI)

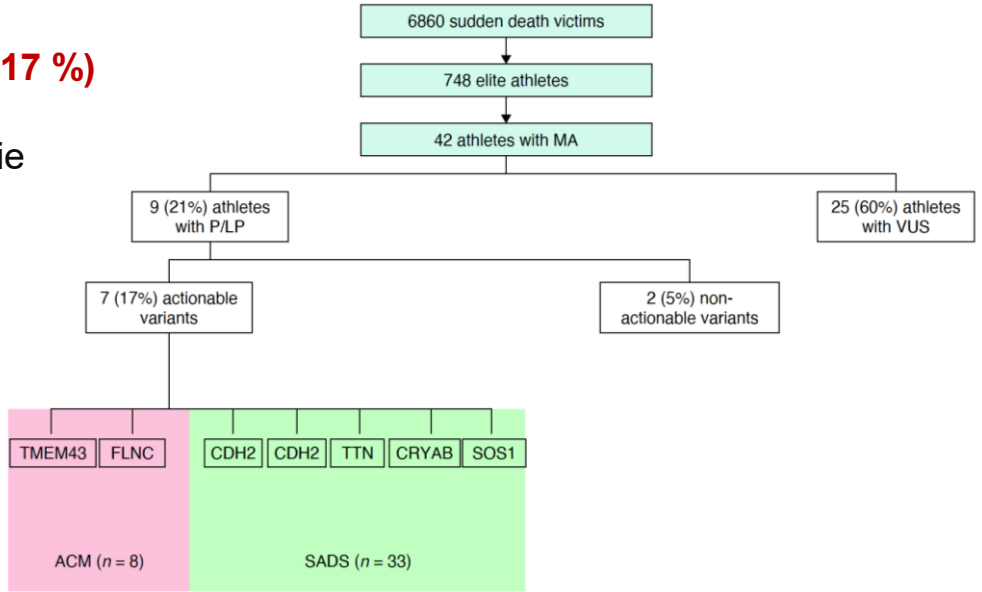
- Cœur structurellement normal (SADS): n= 33 (78 %)
- Cardiomyopathie arythmogène (CMA) : n= 8 (19 %)
- fibrose VG : n=1 (2 %).

Variants jugés cliniquement actionnables : n=7 (17 %)

- CMA: n=2 (FLNC et TMEM43)
- SADS: n=5, gènes associés à la cardiomyopathie

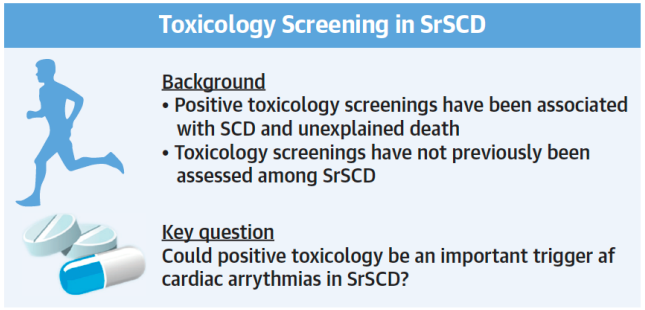
(et non de canalopathies)

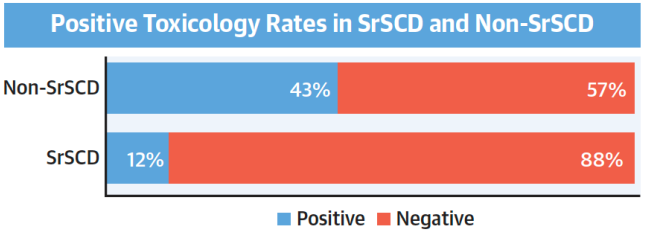
Rendement de l'AM = 17 %.



Finocchiaro G, et al. Yield of molecular autopsy in sudden cardiac death in athletes: data from a large registry in the UK. Europace 2024

Recherche des toxiques en cas de mort subite chez l'athlète





Age 12- 49 ans + autopsie

Dépistage de toxique + = détection dans le sang de toute drogue illégale ou non (médicaments)

Les doses létales ont été exclues

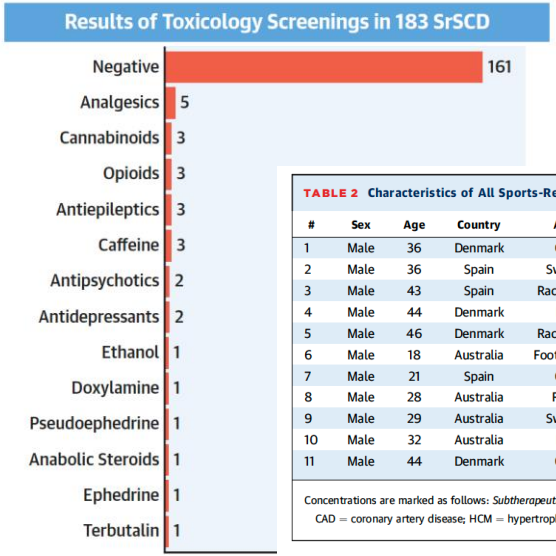


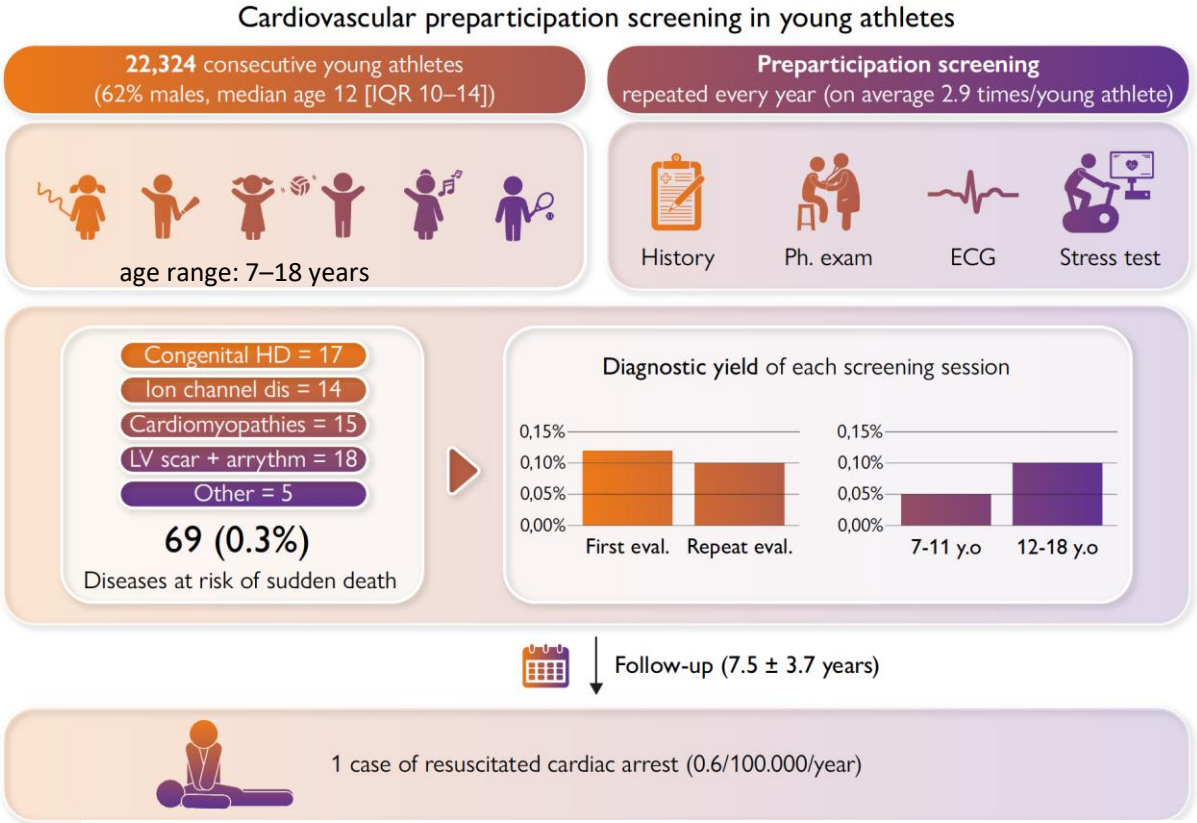
TABLE 2 Characteristics of All Sports-Related Sudden Cardiac Death Cases With SCD-Associated Drugs Detected at Post Mortem

#	Sex	Age	Country	Activity	Cause of Death	Drug 1	Drug 2	Drug 3	Drug 4
1	Male	36	Denmark	Cycling	CAD (acute)	Ephedrine	–	–	–
2	Male	36	Spain	Swimming	CAD (chronic)	Clozapine	Risperidone	–	–
3	Male	43	Spain	Racket sports	CAD (acute)	Ethanol	–	–	–
4	Male	44	Denmark	Fitness	CAD (chronic)	Mianserin	–	–	–
5	Male	46	Denmark	Racket sports	HCM	Lamotrigine	–	–	–
6	Male	18	Australia	Football/rugby	SUD	Cannabinoids	–	–	–
7	Male	21	Spain	Cycling	SUD	Cannabinoids	–	–	–
8	Male	28	Australia	Running	SUD	Pseudoephedrine	–	–	–
9	Male	29	Australia	Swimming	SUD	Cannabinoids	–	–	–
10	Male	32	Australia	Fitness	SUD	Quetiapine	Venlafaxine	Lamotrigine	Olanzapine
11	Male	44	Denmark	Cycling	SUD	Terbutaline	–	–	–

Concentrations are marked as follows: *Subtherapeutic*, *therapeutic*, *supratherapeutic*.
CAD = coronary artery disease; HCM = hypertrophic cardiomyopathy; SUD = sudden unexplained death.

Hansen. CJ, et al. Toxicology Screening in Sports-Related Sudden Cardiac Death A Multinational Observational Study. JACC 2023

Dépistage CV répété chez le jeune athlète

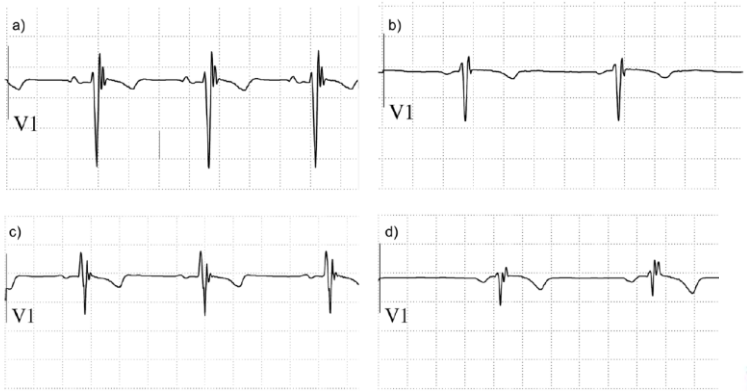


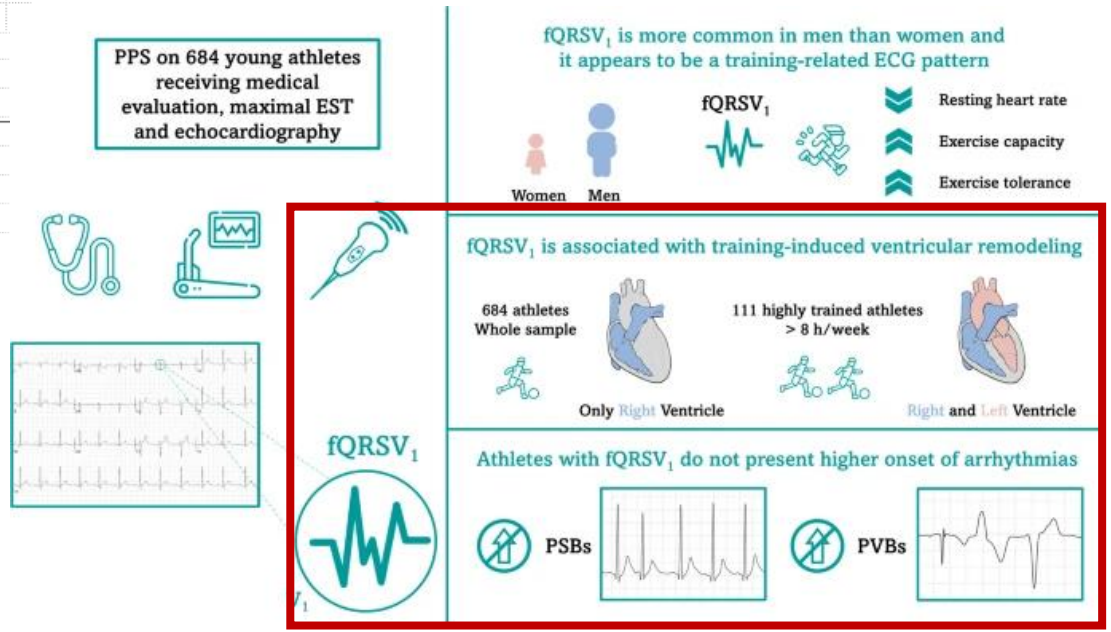
Diagnostic de pathologies non à risque de mort subite (n=334)

- Arythmie ventriculaire idiopathique (n=122)
- Arythmie supraventriculaire complexe: (n=54)
- Anomalies valvulaires (n=45)
- Preexcitation à faible risque: (n=35)
- ANOCOR non à risque: (n=30)
- Cardiopathie congénitale « simple »: (n=26)
- HTA: (n=18)
- Autre : (n=4)

Sarto P, et al. Value of screening for the risk of sudden cardiac death in young competitive athletes. EHJ 2023

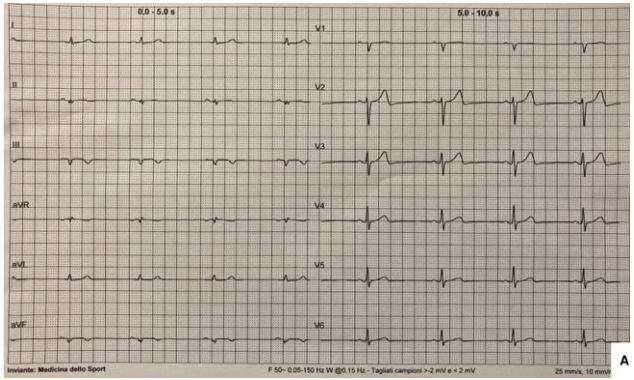
Remodelage ECG: QRS fragmentés en V1?

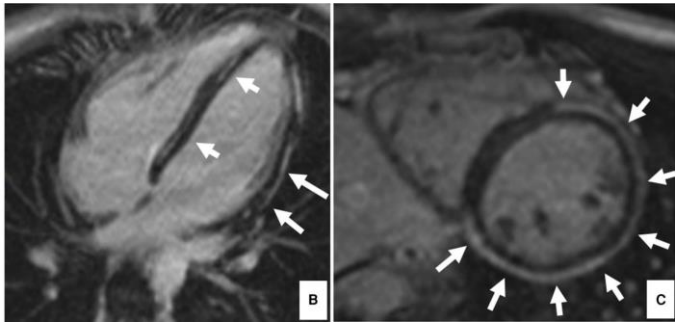




Vecchiato M, et al. The fragmented QRS complex in lead V1: time for an update of the athlete's ECG? Journal of Cardiovascular Translational Research. 2024

Microvoltage ECG





= amplitude des QRS < 0.5 mV dans les dérivations périphériques.

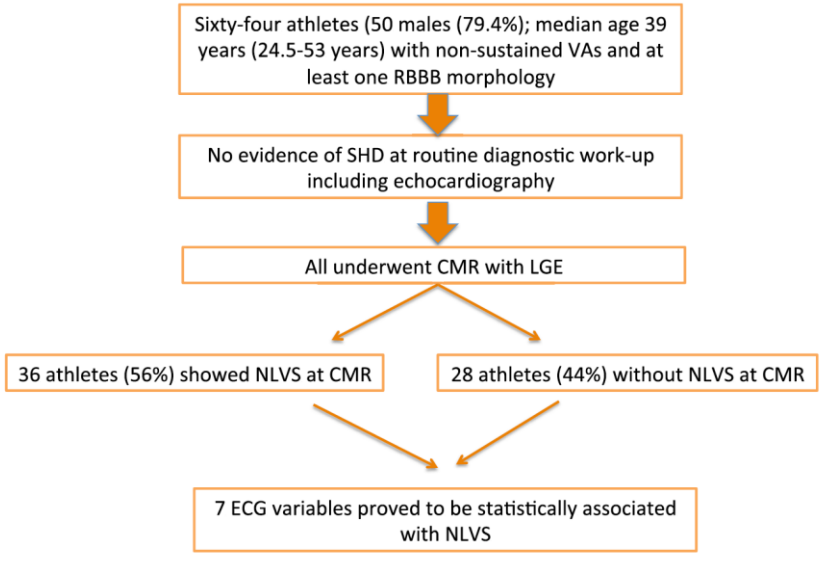
Rare: 2.2 – 4% des ECG d'athlètes élite; 0.5% des tahlètes loisirs; 0.3% des sujets sédentaires sains

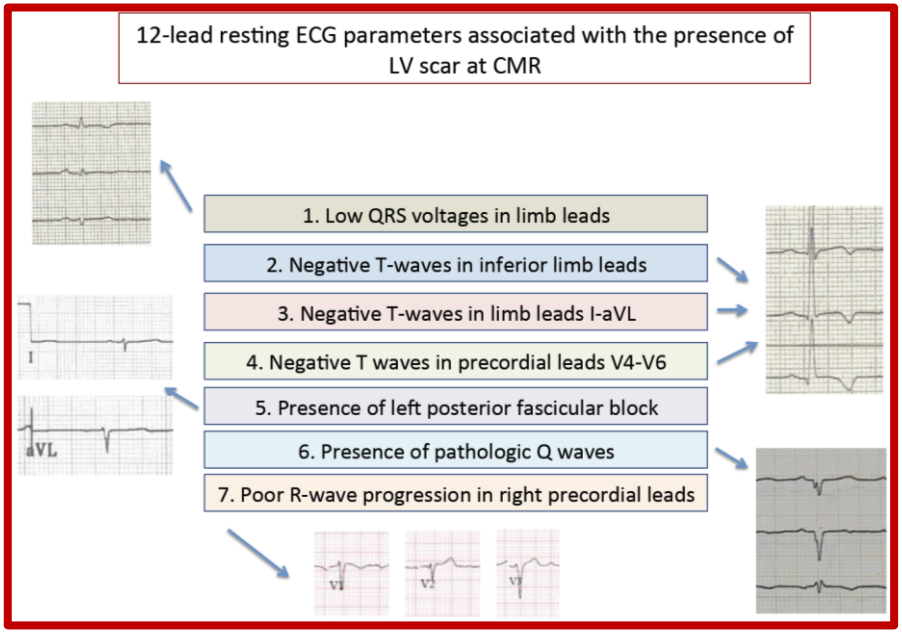
En cas d'antécédent familial de cardiomyopathie – si arythmies ventriculaires non communes sur le tets d'effort ou le Holter ECG alors il faut compléter par une IRM myocardique

Pelliccia A, et al. Prevalence and clinical significance of low QRS voltages in healthy individuals, athletes, and patients with cardiomyopathy: implications for sports pre-participation cardiovascular screening. Eur J Prevent Cardiol. 2024

Arythmies du VG et ECG de repos

Athlètes avec arythmie ventriculaires
BBD (ESV > 500/24h ou doublets ou TVNS)





Sciarra L, et al. Electrocardiographic predictors of left ventricular scar in athletes with right bundle branch block premature ventricular beats. Eur J Prevent Cardiol. 2024

FE réduite chez les athlètes d'endurance – substrat génétique ?

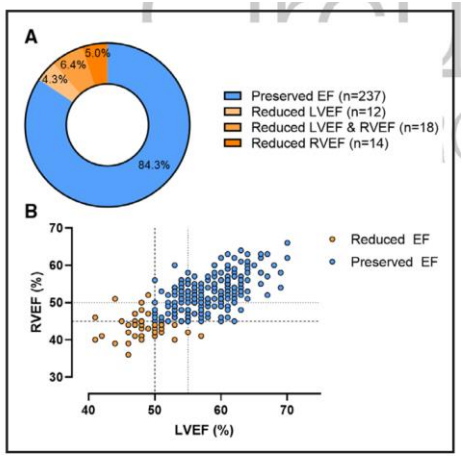


Figure 1. Population distribution on the basis of ejection fraction and the relationship between LVEF and RVEF.

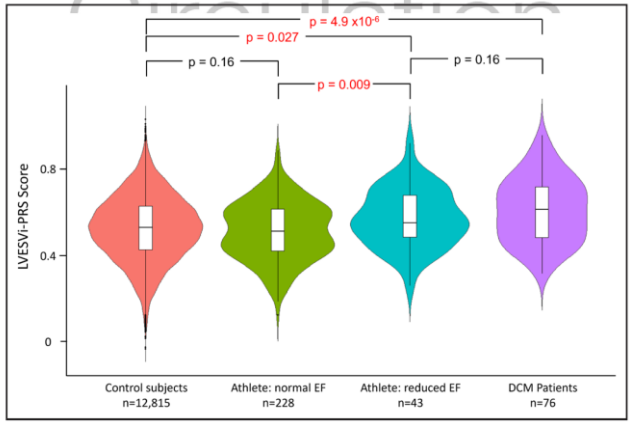


Figure 2. Polygenic risk score for LVESVi: violin plots showing the distribution of LVESVi-PRS in athletes with a reduced or normal EF, in comparison with a healthy elderly population from the ASPREE study[4] and patients with established DCM.

FEVG <50 % et/ou FEVD <45 %

Score de risque polygénique validé pour le Vol. TSVGi- associé aux **CMD** (LVESVi-PRS)

FE réduite associée à :

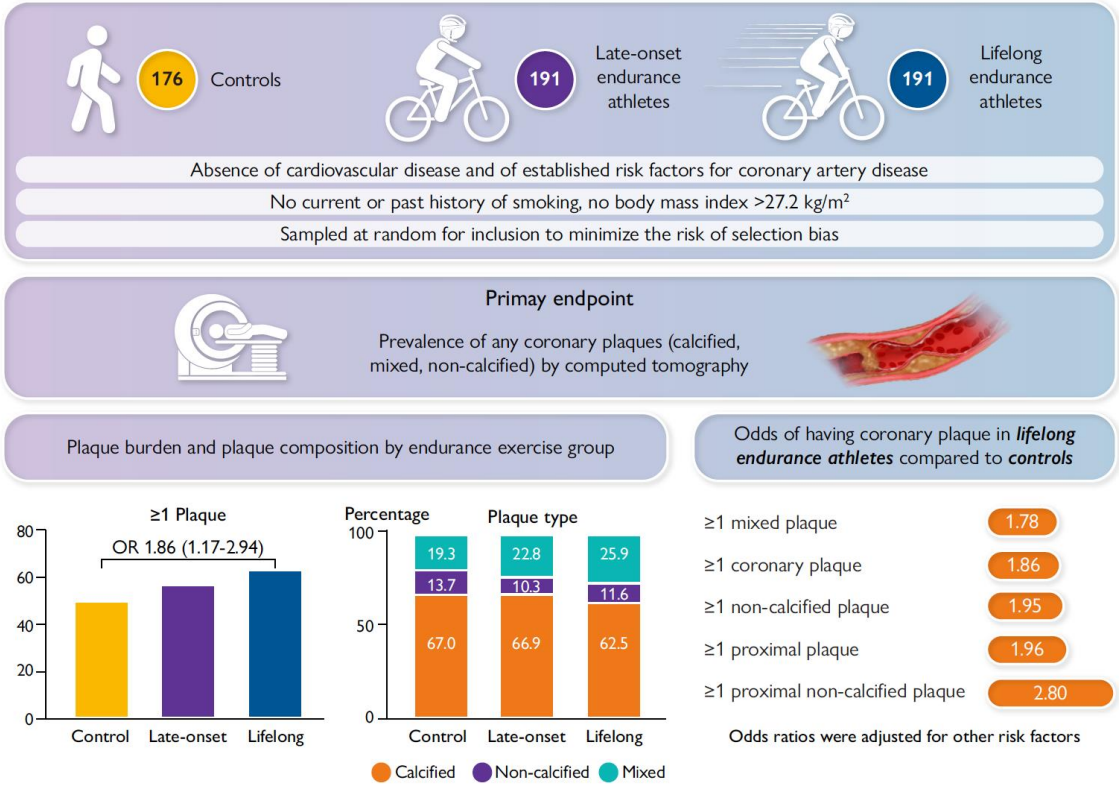
- **+ ESV**
- **LVESVi-PRS moyen plus élevé**

Décile sup de LVESVi-PRS / décile inf = risque x11 de FE réduite

- Suivi: IC symptomatique ou d'arythmies = 0
- MAIS 2 athlètes sont décédés:
  - trauma
  - MS cardiaque (FEVD réduite et LVESVi-PRS >95 %).

Claessen G, et al. Reduced ejection fraction in elite endurance athletes: clinical and genetic overlap with dilated cardiomyopathy. Circ 2023

Athlètes vétérans: plus de plaques coronaires



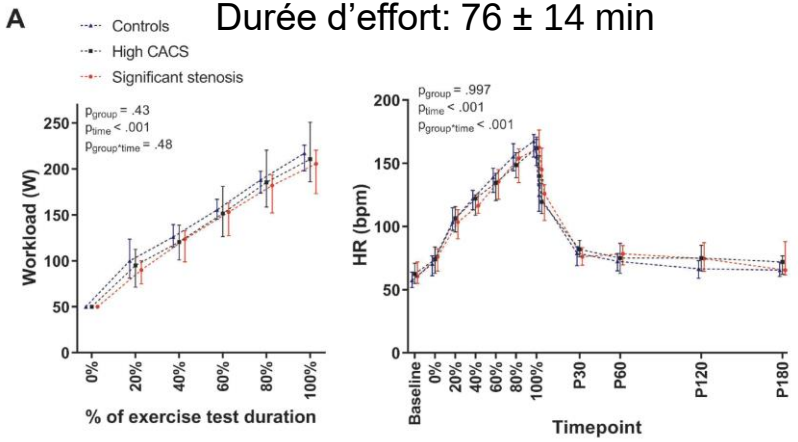
De Bosscher R, et al. Lifelong endurance exercise and its relation with coronary atherosclerosis. EHJ 2023

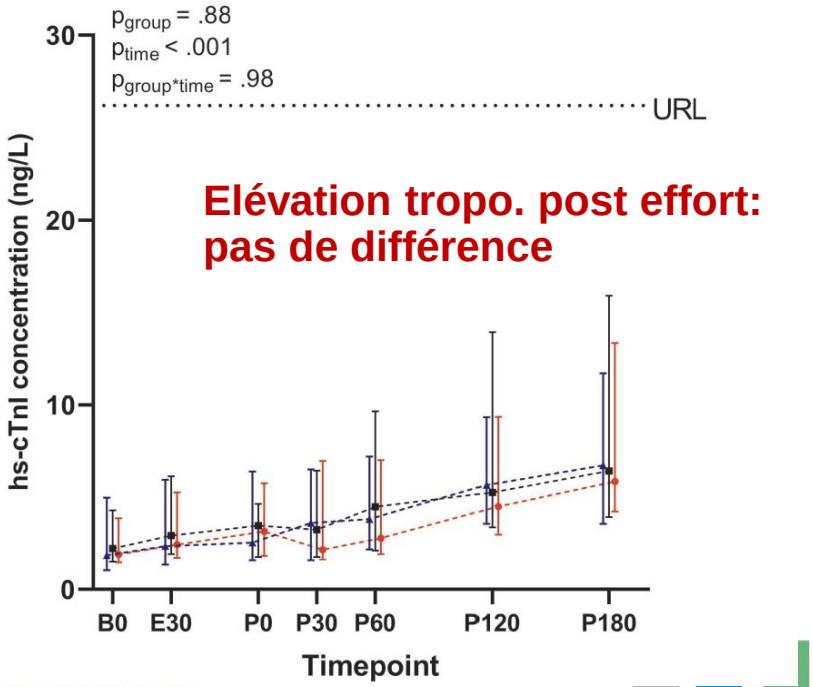
Troponine post test d'effort

Score Calcique 0 (n=20)

Score calcique élevé: ≥ 300 UA ou ≥75^{e} MESA percentile (n=20)

Sténose significative ≥ 50% (n=19) mais sans ischémie à l'effort



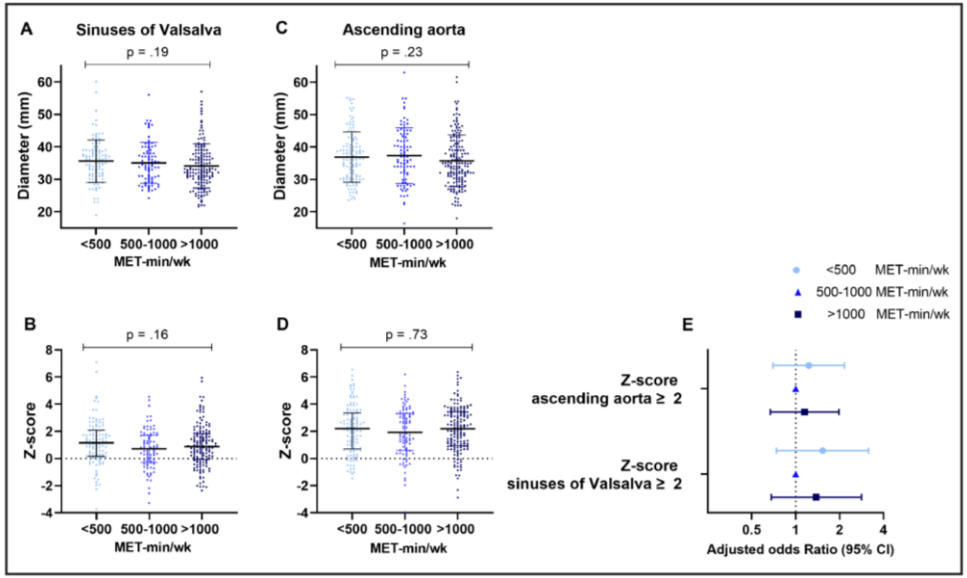


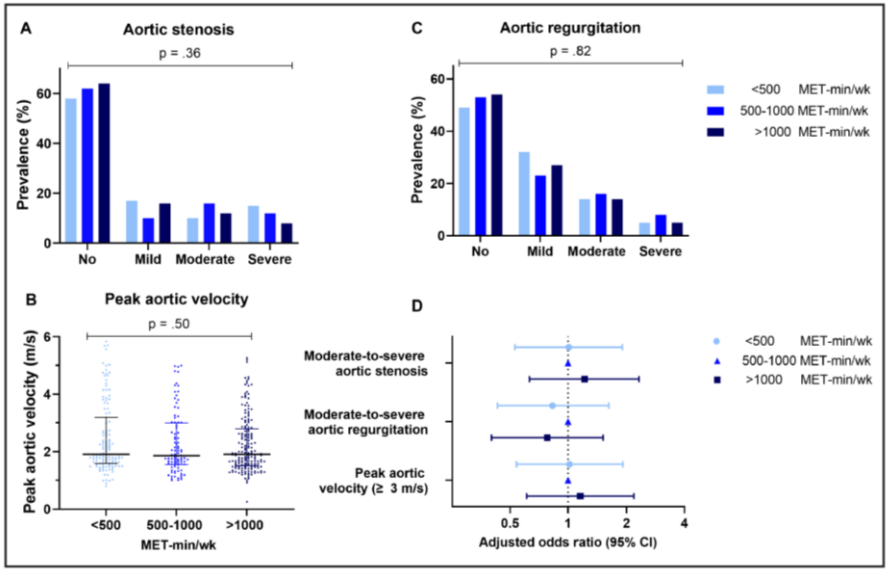
Janssen S, et ak. Exercise-induced cardiac troponin release in athletes with versus without coronary atherosclerosis. Am J Physiol Heart Circ Physiol. 2024

Bicuspidie aortique et sport

Patients avec valve aortique bicuspide (n=407) - suivi: 30 ±17 ans

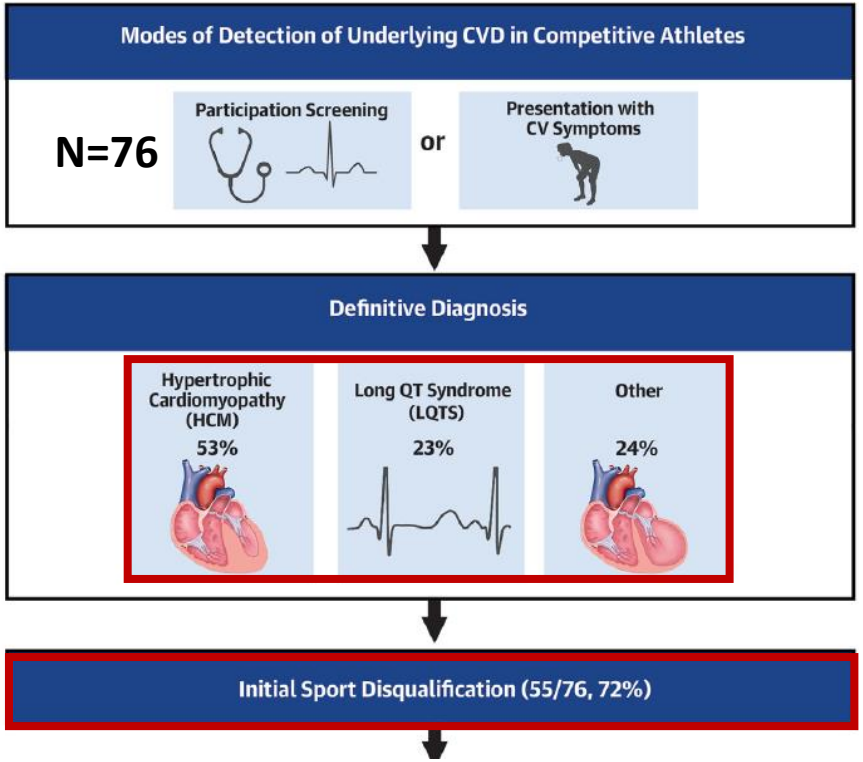
Pas d'association entre : exposition tout au long de la vie à une activité sportive et dysfonction valvulaire ou dilatation de l'aorte.





Schreurs B, et al. Associations of lifelong exercise characteristics with valvular function and aortic diameters in patients with a bicuspid aortic valve. J Am Heart Assoc. 2024.

Sport en compétition malgré une pathologie (CMH – SQTL)



Martinez K, et al. Return-to-Play for Elite Athletes With Genetic Heart Diseases Predisposing to Sudden Cardiac Death. JACC 2023.

Mean age at RTP, y	19.9 ± 5
Female	21 (28)
Symptomatic before diagnosis	28 (37)
Syncope	10 (13)
Cardiac arrest	6 (8)
Palpitations/irregular heart rate	4 (5)
Sustained VT	2 (3)
Other	6 (8)

TABLE 2 Evaluation of RTP

Evaluation of RTP	
Highest level of play	
Division I	50 (66)
Professional	26 (34)
Reason for diagnosis	
Abnormal cardiac evaluation	40 (53)
Syncope	9 (12)
Family history	7 (9)
Unrelated event	4 (5)
(Non)sustained VT	3 (4)
Cardiac arrest	6 (8)
Other symptoms	7 (9)

Sport en compétition malgré une pathologie (CMH – SQTL)

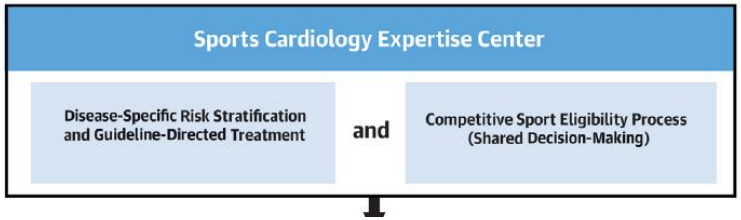


TABLE 3 BCE Details

	Patient 1	Patient 2	Patient 3
Sex	Male	Male	Male
Diagnosis	HCM	LQTS	HCM
Reason for diagnosis	Cardiac arrest	Syncope	Syncope
Sport and level	Basketball	Hockey	Hockey
Age at diagnosis	20	21	22
Age at RTP	21	21	23
Symptoms before diagnosis	Yes	Yes	Yes
	Cardiac arrest	Syncope	Syncope
Initially disqualified	Yes	No	Yes
Treatment	ICD, beta blocker	Beta blocker	Beta blocker
BCE	ICD shock	Syncope	Syncope
Age at BCE, y	22	24	24
Circumstances of BCE	While moving furniture	While coming off the bench and making mac and cheese	While working out

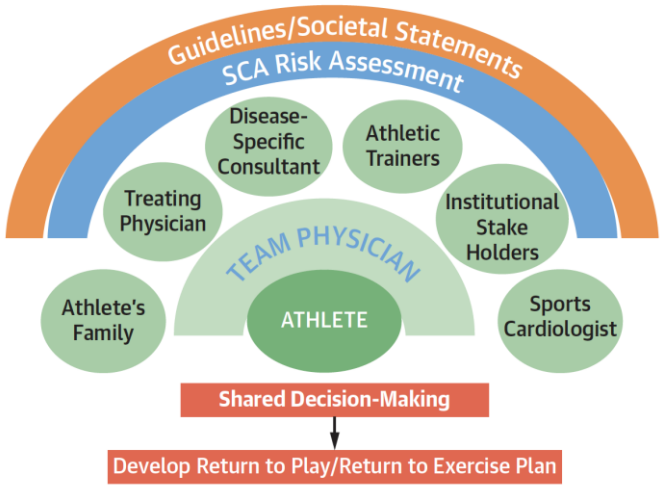
BCE = breakthrough cardiac event; HCM = hypertrophic cardiomyopathy; ICD = implantable cardioverter-defibrillator; LQTS = long QT syndrome; RTP = return to play.

« In all cases, we confirmed that an AED would be readily accessible during all training and competition.
In isolated cases, patients chose to obtain their own AED. »

Martinez K, et al. Return-to-Play for Elite Athletes With Genetic Heart Diseases Predisposing to Sudden Cardiac Death. JACC 2023.

Décision médicale partagée

FIGURE 1 Model for Shared Decision Making for Athletes With Cardiovascular Disease



In the team-physician-led decision-making process, physicians incorporate shared decision making, guided by respect for patients' goals/preferences, while integrating collaborative discussion among the athlete, family, treating physician, team physician, additional expert opinions, and other institutional stakeholders (athletic departments and athletic trainers) in balancing risk-tolerances. SCA = sudden cardiac arrest.

DMP = médecins + patients collaborent pour prendre des décisions de santé ensemble.

Décision conjointe basée sur meilleures preuves disponibles + préférences du patient.

Patient = partenaire actif

Concept fondamental de l'éthique médicale
Consentement

Aucune raison de ne pas l'appliquer à la pratique sportive.

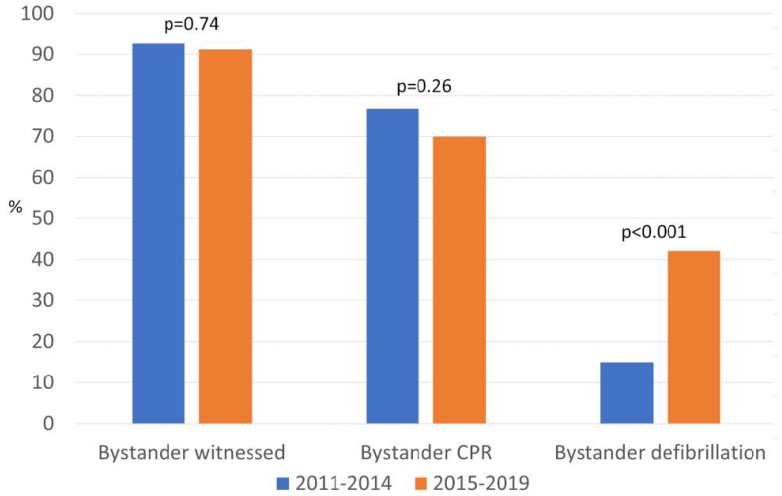
Martinez WM, et al. Sports participation by athletes with cardiovascular disease. JACC 2024

Italie: DSA obligatoire et impact sur la survie.

La loi « Balduzzi »(application 2015)
= DSA obligatoire dans les salles de sport
+ personne formées lors des compétitions

Gianni A, et al. The impact of the Italian law mandating an automatic external defibrillator in all sports venues on sudden cardiac arrest resuscitation rates. Eur J Prevent Cardiol. 2024

Bystander resuscitation manouvers: before and after Balduzzi Law



Successful resuscitation/total number of events: before and after Balduzzi Law

Age classes (years)	< 30	30-39	40-49	50-59	60-69	>70	Total
Before compulsory AED law (2011-2014)	9/13 (69%)	8/12 (67%)	14/22 (64%)	15/20 (75%)	24/32 (75%)	6/14 (43%)	76/113 (67%)
After compulsory AED law (2015-2019)	19/20 (95%)	5/6 (83%)	10/12 (83%)	21/27 (78%)	8/10 (80%)	13/20 (65%)	76/95 (80%)

Pour en savoir plus