

Appendices

Appendix A Classification of Sports[§]

	A. Low dynamic	B. Moderate dynamic	C. High dynamic
I. Low Static	Archery Bowling Cricket Golf Rifle	Table tennis Tennis (doubles) Volleyball Baseball*	Badminton Walking Running (marathon) Cross-country skiing (classic)
II. Moderate Static	Auto racing*~ Diving~ Equestrian*~ Motorcycling*~ Gymnastics* Karate/Judo* Sailing	Fencing Field events (jumping) Figure skating* Lacrosse* Running (sprint)	Basketball* Biathlon Ice hockey* Field hockey* Football* Soccer* Cross-country skiing (skating) Running (middle/long distance) Swimming Squash* Tennis (single) Team handball*
III. High Static	Bobsledding *~ Field events (throwing) Luge*~ Rock Climbing*~ Waterskiing*~ Weight lifting* Windsurfing*~	Body building* Downhill skiing*~ Wrestling*	Boxing* Canoeing, Kayaking Cycling*~ Decathlon Rowing Speed skating

Symbols: *Danger of bodily collision.

~Increased risk if syncope occurs.

§ Adapted and modified after Mitchell et al. (Classification of Sports. JACC 1994, 24:864–866).

Appendix B Recommendations for Competitive Sport Participation in Athletes with Congenital Heart Diseases

Lesion	Evaluation	Criteria for eligibility	Recommendation	Follow-up
Atrial septal defect (closed or small, unoperated) and patent foramen oOvale	History, NYHA functional class, PE, ECG, echo, chest X-ray, ET	<6 mm defect, or 6 months postclosure, with normal pulmonary artery pressure, no significant arrhythmia or ventricular dysfunction	All sports In patients with PFO percutaneous closure may be considered before regular scuba diving	Yearly
Ventricular septal defect (closed or small unoperated)	History, NYHA functional class, PE, ECG, echo, chest X-ray, ET	Restrictive defect (left-to-right gradient >64 mmHg) or 6 months postclosure, no pulmonary hypertension	All sports	Yearly
Atrioventricular septal defect	History, NYHA functional class, PE, ECG, echo, chest X-ray, ET	No or only mild AV valve insufficiency, no significant subaortic stenosis or arrhythmia, normal maximal gas exchange measurements	All sports	Yearly. Complete reassessment every 2nd year
Partial or complete Anomalous Pulmonary Venous Connection	History, NYHA functional class, PE, ECG, echo, chest X-ray, ET, MRI	No significant pulmonary or systemic venous obstruction, no pulmonary hypertension or exercise-induced atrial arrhythmia	All sports	Yearly
Persistent ductus Arteriosus (operated)	History, NYHA functional class, PE, ECG, echo, chest X-ray, ET	Six months postclosure and no residual pulmonary hypertension	All sports	Not needed
Pulmonary stenosis (mild native or treated)	History, NYHA functional class, PE, ECG, echo, chest X-ray, ET	Native or 6 months postinterventional/postsurgical; peak transvalvular gradient <30 mmHg, normal RV, normal ECG or only mild RV hypertrophy, no significant arrhythmias	All sports	Yearly

Appendix B (continued)

Lesion	Evaluation	Criteria for eligibility	Recommendation	Follow-up
Pulmonary stenosis (moderate native or treated)	History, NYHA functional class, PE, ECG, echo, chest X-ray, ET	Native or 6 months postinterventional/posturgical; peak transvalvular gradient between 30 and 50 mmHg, normal RV, normal ECG or only mild RV hypertrophy	Low and moderate dynamic and low static sport (I A,B)	Every 6 months
Coarctation of the aorta (native or repaired)	History, NYHA functional class, PE, ECG, echo, chest X-ray, ET, MRI	No systemic hypertension; peak pressure gradient between the upper and lower limbs of <21 mmHg, a peak systolic BP during exercise of <231 mmHg, no ischemia on exercise ECG, no left ventricular overload	Low and moderate dynamic and static sport (I, II A, B) If interposed graft avoid sport with a risk of bodily collision	Yearly. Complete reassessment every 2nd year
Aortic stenosis (mild)	History, NYHA functional class, PE, ECG, echo, chest X-ray, ET	Mean transvalvular gradient <21 mmHg, no history of arrhythmia, no syncope, dizziness or angina pectoris	All sports, with exception of high static, high dynamic sports	Yearly
Aortic stenosis (moderate)	History, NYHA functional class, PE, ECG, echo, chest X-ray, ET, 24-h Holter	Mean transvalvular gradient between 21 and 49 mmHg, no history of arrhythmia, no syncope, dizziness or angina pectoris	Low dynamic and static sport (I A)	Every 6 months

Appendix B (continued)

Lesion	Evaluation	Criteria for eligibility	Recommendation	Follow-up
Tetralogy of Fallot	History, NYHA functional class, PE, ECG, echo, chest X-ray, ET, 24-h Holter, MRI	Non or only mild RVOT obstruction, no more than mild pulmonary regurgitation, a normal or near normal biventricular function and no evidence of arrhythmia Moderate residual lesion with RV pressure <50% of systemic pressure, or residual VSD or moderate pulmonary regurgitation, but normal biventricular function	Low and moderate static and dynamic sport. (I, II A, B) Low static and dynamic sport. (I A) Patients with conduit should avoid sport with risk of bodily collision	Yearly. Complete reassessment every 2nd year
Transposition of the great arteries (arterial switch)	History, NYHA functional class, PE, ECG, echo, chest X-ray, ET	No or only mild neo-aortic insufficiency, no significant pulmonary stenosis, no signs of ischemia or arrhythmia on exercise ECG	All sports, with exception of high static, high dynamic sports	Yearly

Abbreviations: ECG = 12-lead electrocardiogram; ET = exercise testing; Echo = echocardiography; PE = physical examination; MRI = cardiac magnetic resonance imaging; 24-h Holter = 24 h Holter ECG monitoring
Follow-up includes medical record, NYHA functional class, PE, ECG, echo. Supplementary investigation will be performed dependent on lesion and symptoms.

Appendix C Recommendations for Competitive Sport Participation in Athletes with Valvular Disease

Lesion	Evaluation	Criteria for eligibility	Recommendations	Follow-up
Mitral valve stenosis	History, PE, ECG, ET, echo	Mild stenosis, stable sinus rhythm	All sports, with exception of high dynamic and high static (III C)	Yearly
		Mild stenosis in atrial fibrillation, and anticoagulation	Low-moderate dynamic, low-moderate static (I-II, A, B), No contact sport	Yearly
Mitral valve regurgitation	History, PE, ECG, ET, echo	Moderate and severe stenosis (atrial fibrillation or sinus rhythm)	Low dynamic and low static (IA)	Yearly
		Mild to moderate regurgitation, stable sinus rhythm, normal LV size/function, normal exercise testing	No contact sport	Yearly
		Mild to moderate regurgitation, normal LV size and function, normal exercise testing. If atrial fibrillation, in anticoagulation	All sports	Yearly
Mitral valve regurgitation	History, PE, ECG, ET, echo	Mild to moderate regurgitation, mild LV dilatation (end-systolic volume <55 mL/m ²), normal LV function, in sinus rhythm	All sports, with exception of contact sport	Yearly
		Mild to moderate regurgitation, LV enlargement (end-systolic volume >55 mL/m ²) or LV dysfunction (ejection fraction <50%)	Low-moderate dynamic, low-moderate static (I-II, A,B)	Yearly
Severe regurgitation		Severe regurgitation	No competitive sports	No competitive sports

Appendix C (continued)

Lesion	Evaluation	Criteria for eligibility	Recommendations	Follow-up
Aortic valve stenosis	History, PE, ECG, ET, echo	Mild stenosis, normal LV size and function at rest and under stress, no symptoms, no significant arrhythmia Moderate stenosis, normal LV function at rest and under stress, frequent/complex arrhythmias Moderate stenosis, LV dysfunction at rest or under stress, symptoms Severe stenosis	Low-moderate dynamic, low-moderate static (I-II, A,B) Low dynamic and low static (IA) No competitive sports	Yearly Yearly
Aortic valve regurgitation	History, PE, ECG, ET, echo	Mild to moderate regurgitation, normal LV size and function, normal exercise testing, no significant arrhythmia Mild to moderate regurgitation, proof of progressive LV dilatation Mild to moderate regurgitation, significant ventricular arrhythmia at rest or under stress, dilatation of the ascending aorta Severe regurgitation No symptoms	No competitive sports All sports Low dynamic and low static (IA) No competitive sports	Yearly Yearly
Tricuspid valve stenosis	History, PE, ECG, ET, echo	No symptoms	No competitive sports Low-moderate dynamic, low-moderate static (I-II, A,B)	Every 2nd year

Appendix C (continued)

Lesion	Evaluation	Criteria for eligibility	Recommendations	Follow-up
Tricuspid valve regurgitation	History, PE, ECG, ET, echo	Mild to moderate regurgitation	Low-moderate dynamic, low-moderate static (I-II, A – B)	Yearly
Poly-valvular diseases	History, PE, ECG, ET, echo	Any degree, with right atrial pressure more than 20 mmHg	No competitive sports see most relevant defect	
Bioprosthetic aortic or mitral valve	History, PE, ECG, ET, echo	Normal valve function and normal LV function, in stable sinus rhythm	Low-moderate dynamic, low-moderate static (I-II, A,B)	Yearly
Prosthetic (artificial) aortic or mitral valve	History, PE, ECG, ET, echo	Normal valve function and normal LV function, in atrial fibrillation	Low-moderate dynamic, low-moderate static (I-II, A,B)	Yearly
Post valvuloplasty	History, PE, ECG, ET, echo	See the residual severity of the mitral valve stenosis or mitral valve regurgitation	No contact types of sport Low-moderate dynamic, low-moderate static (I-II, A,B)	Yearly
Mitral valve prolapse	History, PE, ECG, ET, echo	If unexplained syncope, or family history of sudden death, or complex supraventricular or ventricular arrhythmias, or long QT interval or severe mitral regurgitation	No contact types of sport No competitive sports	Yearly
		Absence of the above cited cases	All sports	Yearly

Abbreviations: ECG: 12-lead electrocardiography; Echo = Echocardiography; ET: exercise stress testing; PE = physical examination; Sport type: see Appendix A.

Appendix D Recommendation for Competitive Sport Participation in Athletes with Cardiomyopathies, Myocarditis and Pericarditis

Lesion	Evaluation	Criteria for eligibility	Recommendations	Follow-up
Athletes with definite diagnosis of HCM	History, PE, ECG, echo		No competitive sports	
Athletes with definite diagnosis of HCM but low risk profile	History, PE, ECG, echo, ET, 24-h Holter	No SD in the relatives, no symptoms; mild LVH, normal BP response to exercise; no ventricular arrhythmias	Low dynamic, low static sports (I A)	Yearly
Athletes with only gene abnormalities of HCM, without phenotype changes	History, PE, ECG, echo	No symptoms, no LVH, no ventricular arrhythmias	Only recreational, non-competitive sport activities	Yearly
Athletes with definite diagnosis of DCM	History, PE, ECG, echo		No competitive sports	
Athletes with definite diagnosis of DCM but low risk profile	History, PE, ECG, echo, ET, 24-h Holter	No SD in the relatives, no symptoms; mildly depressed EF ($\geq 40\%$), normal BP response to exercise; no complex ventricular arrhythmias	Low-moderate dynamic and low static sports (IA, IB)	Yearly
Athletes with definite diagnosis of ARVC	History, PE, ECG, echo		No competitive sports	
Athletes with active myocarditis, or pericarditis	History, PE, ECG, echo		No competitive sports	
Athletes after resolution of myocarditis	History, PE, ECG, echo, ET	No symptoms, normal LV function, no arrhythmias	All competitive sports	1st control within 6 months*
Athletes after resolution of pericarditis	History, PE, ECG, echo, ET	No symptoms, normal LV function, No arrhythmias	All competitive sports	1st control within 6 months*

Abbreviations: ARVC = arrhythmogenic right ventricular cardiomyopathy; BP = blood pressure; DCM = dilated cardiomyopathy; HCM = hypertrophic cardiomyopathy; Echo = Echocardiography; EF = ejection fraction; ET = Exercise testing; 24-h Holter: 24-h Holter ECG monitoring; LV = left ventricular; LVH = left ventricular hypertrophy; PE physical examination; SD = sudden death; Sport type, see Appendix A.

* Subsequent controls according to the individual case.

Appendix E Recommendation for Competitive Sport Participation in Athletes with Marfan’s Syndrome

Phenotype	Genotype	Criteria for eligibility	Recommendations	Follow-up
Adult with full phenotype; adolescent with incomplete phenotype; children/adolescent without phenotype	Positive		No competitive sports	
Athletes (adults) with full phenotype	Not available		No competitive sports	
Athletes (adolescents) with incomplete phenotype	Not available	Positive family history	No competitive sports	
Athletes (adolescents) with incomplete phenotype	Not available	Negative family history	Continued sport participation with follow-up	Yearly
Athletes (children/adolescent) without phenotype	Not available	Positive family history	Continued sport participation with follow-up	Yearly

Appendix F Stratification of Risk to Quantify Prognosis in Patients with Systemic Hypertension

Other risk factors and disease history	Clinic blood pressure (mmHg)		
	Grade 1 SBP 140–159 or DBP 90–99	Grade 2 SBP 160–179 or DBP 100–109	Grade 3 SBP = 180 or DBP = 110
No other risk factors ^a	Low added risk	Moderate added risk	High added risk
1–2 risk factors ^a	Moderate added risk	Moderate added risk	Very high added risk
3 or more risk factors ^a or TOD ^b or diabetes	High added risk	High added risk	Very high added risk
Associated clinical conditions ^c	Very high added risk	Very high added risk	Very high added risk

Abbreviations: TOD = target organ damage; SBP = systolic blood pressure; DBP = diastolic blood pressure. Low, moderate, high and very high added risk indicate an approximate 10-year risk of fatal and nonfatal cardiovascular disease of <15%, 15–20%, 20–30% and >30%, or of fatal cardiovascular disease of <4%, 4–5%, 5–8% and >8%.

Symbols: ^a Risk factors used for stratification: blood pressure level (grades 1–3); gender and age (men >55 years; women >65 years); smoking; dyslipidaemia (total cholesterol >250 mg/dL or LDL-cholesterol >155 mg/dL or HDL-cholesterol <40 mg/dL in men and <48 mg/dL in women); abdominal obesity (men =102 cm; women =88 cm); 1st degree family history of premature cardiovascular disease (men <55 years; women <65 years)

^b Target organ damage: hypertension-induced left ventricular hypertrophy; ultrasound evidence of arterial wall thickening or atherosclerotic plaque; slight increase in serum creatinine (men 1.3–1.5 mg/dL; women 1.2–1.4 mg/dL); presence of micro-albuminuria

^c Associated clinical conditions: cerebrovascular disease; ischaemic heart disease; heart failure; peripheral vascular disease; renal impairment; proteinuria; advanced retinopathy (haemorrhages; exsudates; papilloedema)

Appendix G Recommendation for Competitive Sport Participation in Athletes with Systemic Hypertension (and Other Risk Factors) According to the Cardiovascular Risk Profile

Lesion	Evaluation	Criteria for eligibility	Recommendations	Follow-up
Low added risk	History, PE, ECG, ET; echo	Well controlled BP	All sports	Yearly
Moderate added risk	History, PE, ECG, ET; echo	Well controlled BP and risk factors	All sports, with exclusion of high static, high dynamic sports (III C)	Yearly
High added risk	History, PE, ECG, ET; echo	Well controlled BP and risk factors	All sports, with exclusion of high static sports (III A–C)	Yearly
Very high added risk	History, PE, ECG, ET; echo	Well controlled BP and risk factors; no associated clinical conditions	Only low-moderate dynamic, low static sports (I A,B)	6 months

Abbreviations: BP = blood pressure; LVH = left ventricular hypertrophy; PE : physical examination, including repeated blood pressure measurements according to guidelines^{54–57}

Symbols: ^{a, b, c} as in Appendix F

Appendix H Recommendation for Competitive Sport Participation in Athletes with Ischemic Heart Disease

Lesion	Evaluation	Criteria for eligibility	Recommendations	Follow-up
Athletes with definite diagnosis of IHD and high probability of cardiac events	History, ECG, ET, echo, coronary-angiography		No competitive sports allowed	
Athletes with definite diagnosis of IHD and low probability of cardiac events	History, ECG, ET, echo, coronary-angiography	No exercise induced ischemia, no symptoms or major arrhythmias, not significant (<50%) coronary lesions, EF >50%	Only low-moderate dynamic and low static sports (IA, IB)	Yearly
Athletes without evidence of IHD but with high risk profile (>5% global SCORE)	History, ECG, ET	If positive provocative ECGs, further testing are needed (stress echo, scintigraphy and/or coronary angiography) to confirm IHD. If positive, consider as athletes with diagnosis of IHD	Only low-moderate dynamic and low static sports (IA, IB)	Yearly
Athletes without evidence of IHD and low risk profile	History, ECG, ET optional	If negative provocative ECGs	Individual based decision; avoid high static sports (IIIA–C) All competitive sports	Yearly Every 1–3 years

Abbreviations: ECG = 12-lead electrocardiogram; ET = Exercise testing or other provocative testing; IHD = ischemic heart disease; Sport type I–III, A–C, see Appendix A

Appendix I Recommendation for Competitive Sport Participation in Athletes with Arrhythmias and Arrhythmogenic Conditions

Lesion	Evaluation	Criteria for eligibility	Recommendations	Follow-up
Marked sinus bradycardia (<40 bpm) and/or sinus pauses ≥ 3 s with symptoms	History, ECG, ET, 24-h Holter, echo	(a) If symptoms [#] are present (b) After >3 months from resolution of symptoms [#] ; off therapy	(a) Temporary interruption of sport (b) All sports	Yearly
(a) A-V block 1st and 2nd degree, type 1	History, ECG, ET, 24-h Holter, echo	(a) If no symptoms [#] , no cardiac disease, with resolution during exercise	(a) All sports (b) Low-moderate dynamic, low-moderate static sports (I, II A,B)	Yearly
(b) A-V block 2nd degree, type 2 or advanced		(b) In the absence of symptoms, cardiac disease, ventricular arrhythmias during exercise, and if resting heart rate is >40 bpm		
Supraventricular premature beats	History, ECG, thyroid function	No symptoms [#] , no cardiac disease	All sports	Not required
Paroxysmal supraventricular tachycardia (AVNRT or AVRT over a concealed accessory pathway)	History, ECG, echo, EP study	Ablation is recommended: (a) After catheter ablation: if no recurrences for >3 months, and no cardiac disease (b) If ablation is not performed and AVNRT is sporadic, without cardiac disease, without hemodynamic consequences and without relation with exercise	(a) All sports (b) All sports, except those with increased risk	Yearly
Ventricular pre-excitation (WPW syndrome) and:	(a, b, c) History, ECG, echo, EP study	(a, b) Ablation is mandatory after catheter ablation: if no recurrences, no cardiac disease (c) Ablation is recommended but not mandatory.	(a, b) All sports (c) Asymptomatic athletes at low risk and not ablated: all sports, except those with increased risk*	Yearly
(a) Paroxysmal AV reentry tachycardia				
(b) Atrial fibrillation or flutter				
(c) Asymptomatic pre-excitation pattern				

Appendix I (continued)

Lesion	Evaluation	Criteria for eligibility	Recommendations	Follow-up
Atrial fibrillation (paroxysmal, permanent)	History, ECG, echo, ET, 24-h Holter	(a) After paroxysmal AF; if no cardiac disease, no WPW, and stable sinus rhythm >3 months (b) Permanent A F in the absence of cardiac disease, and WPW; assess heart rate and LV function response to exercise Ablation is mandatory after ablation: if no symptoms [#] for >3 months, no cardiac disease or WPW, and off therapy;	(a) All sports (b) Assessed on individual basis	(a) Yearly (b) Every 6 months
Atrial flutter	History, ECG, echo, EP study	In the absence of cardiac disease or arrhythmic condition [^] , family history of SD, symptoms [#] , relation with exercise, frequent and/or polymorphic PVCs and/or frequent couplets with short RR interval	All sports	Yearly
Premature ventricular beats	History, ECG, echo (ET, 24-h Holter, in selected cases invasive tests)	In the absence of cardiac disease or arrhythmic condition [^] , family history of SD, symptoms [#] , relation with exercise, frequent and/or polymorphic PVCs and/or frequent couplets with short RR interval	All sports	Yearly
Nonsustained ventricular tachycardia	History, ECG, echo (ET, 24-h Holter, in selected cases invasive tests)	In the absence of cardiac disease or arrhythmic condition [^] , symptoms [#] , family history of SD, relation with exercise, multiple episodes of NSVT with short RR interval	All sports	Every 6 months
Slow ventricular tachycardia, fascicular ventricular tachycardia, right ventricular outflow tachycardia	History, ECG, echo, ET, 24-h Holter (in selected cases EP study)	In the absence of cardiac disease or arrhythmic condition [^] , family history of SD, symptoms [#]	All sports, except those with increased risk [*]	Every 6 months
Syncope	History, ECG, echo, ET, 24-h Holter; tilting test	(a) Neurocardiogenic (b) Arrhythmic or primary cardiac	(a) All sports (except those with increased risk [*]) (b) See specific cause	Yearly

Appendix I (continued)

Lesion	Evaluation	Criteria for eligibility	Recommendations	Follow-up
Long QT syndrome	History, ECG, (24-h Holter, genetic testing)	Positive long QT syndrome	No competitive sports	
Brugada syndrome	History, ECG, provocative test	Positive Brugada syndrome	No competitive sports	
Implanted pacemaker	ECG, echo, ET, 24-h Holter	Normal heart rate increase during exercise, no significant arrhythmias, normal cardiac function	Low-moderate dynamic and low static sports (I, II A), except those with risk of bodily collision	Yearly
Implantable cardioverter defibrillator	ECG, echo, ET, 24-h Holter	No malignant VTs; normal cardiac function; at least 6 months after the implantation, or the last ICD intervention	Low-moderate dynamic and low static sports (I, II A), except those with risk of bodily collision	Yearly

Abbreviations: ECG = 12-lead electrocardiogram; Echo = echocardiography; ET = Exercise testing; 24-h Holter = 24-h Holter monitoring; EP = Electro-physiologic; Sport types, see Appendix A
Symbols: * increased risk if syncope occurs (see Classification of Sports);
 # symptoms include presyncope, lightheadedness, exertional fatigue;
 ^ arrhythmogenic conditions include cardiomyopathies, ischemic heart disease and channelopathies
 NB. For athletes with structural heart disease, see the recommendations of the disease

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