Index

abnormal electrocardiographic findings
cardiomyopathy
atrial enlargement, 110–111
ECG phenotypes, 112
intraventricular conduction abnormalities, 109–110
left ventricular hypertrophy, 108–109
pathological Q-waves, 108
premature ventricular contractions (PVCs), 112
QRS-axis deviation, voltage criteria for, 110–111
QRS fragmentation, 109–110
right ventricular hypertrophy, 109
ST-segment depression, 108
T-wave inversion, 106–108
primary electrical disease
Brugada pattern, 117–119
heart block, 124–125
long QT syndrome, 114–117
premature ventricular contractions, 122–123
short QT syndrome, 117
sinus bradycardia, 123–124
sudden death syndromes, 126
supraventricular tachycardias, 122
ventricular arrhythmias, 122–123
Wolf–Parkinson–White (WPW), 119–122
abnormal physical examination findings, 395–404
abdomen, 403
added heart sounds, 402–403
ankle brachial pressure indices (ABPIs), 404
atrial septal defect (ASD), 399
blood pressure, 397–399
cardiac auscultation, 400–402
cardiac auscultation, 400–402
face and neck, 399
general inspection, 395–396
hands, 396–397
heart, 400–403
hypertrophic cardiomyopathy, 402
iliac artery insufficiency, 404
inherited connective-tissue disorders, 400
lower limbs, 403–404
lungs, 403
radial pulse, 396
thorax, 399–400
acetylcholine (ACh), 17
acetyl coenzyme A (acetyl-CoA), 22
acidosis, 24
action potentials, 6
adenosine diphosphate (ADP), 22
adenosine monophosphate (AMP), 22
adenosine triphosphate (ATP), 22, 34
adverse events, 57
aerobic exercise, 39
AHA. see American Heart Association (AHA)
alacatic anaerobic pathways, 27
ALCAPA. see anomalous origin of the left coronary artery from the pulmonary artery (ALCAPA)
American College of Cardiology (ACC), 80
American College of Medical Genetics and Genomics (ACMG), 183
American Heart Association (AHA), 75, 82–83, 280
14-elements, 83
American Society of Echocardiography (ASE), 130
AMP-activated protein kinase (PRKAG2), 316
anaerobic capacity, 27
anaerobic energy production, 29
anaerobic power, 27
androgenic-anabolic steroid (AAS), 192
angina pectoris, 54
angiotensin-converting enzyme (ACE), 57, 232
anomalous coronary artery
AHA/ACC guidelines and ESC consensus recommendations, 381
SCD, 193
anomalous origin of the left coronary artery from the pulmonary artery (ALCAPA), 275
anterior T-wave inversion, 106
aortic dissection, 199–200
aortic regurgitation (AR)
clinical presentation, 257
exercise recommendations, 257
outcomes and management, 257
pathophysiology, 256–257
aortic stenosis (AS)
clinical presentation, 256
exercise recommendations, 256
outcomes and management, 256
pathophysiology, 255–256
aortic valvular disease
aortic regurgitation, 256–257
aortic stenosis, 255–256
bicuspid aortic valve disease, 253–255
aortopathies, 245. see also Marfan’s syndrome
coronary artery disease and hypertension, 379–383
apical hypertrophy, 131
arrhythmias
assessment and prevention of, 268
syndrome, 114
arrhythmogenic cardiomyopathy, 196, 197
arrhythmogenic right ventricular cardiomyopathy (ARVC), 45, 98, 99, 122, 123, 169–170, 182, 231. see also dilated cardiomyopathy (DCM)
AHA/ACC guidelines and ESC consensus recommendations, 374
clinical management, 226–229
diagnosis, 219–223
pathophysiology and natural history, 217–219
sudden death, prevention of, 223–226
arterial baroreflex, 34
arterial circulation, 13
ARVC. see arrhythmogenic right ventricular cardiomyopathy (ARVC)
asthma, 368
atheromatic events, 59
atherosclerotic disease, prevention and management of CVD, preventing, 53–55
exercise rehabilitation, 56–57
exertion-related events, 57
physical activity, 53
post-myocardial infarction, 59
post-surgery and early rehabilitation, 58
rehabilitation and secondary prevention, 55–56
athlete's heart, 165
differentiation from, 209–210
electrical remodelling in, 43
influence
age, 44–45
ethnicity, 46–49
sex, 46
sporting discipline, 49
structural remodelling in, 43–44
athletes vs. non-athletes, 71
athletes with implantable
cardioverter-defibrillators
AHA/ACC and ESC consensus
recommendations, 379
athletic remodelling, 165, 167
atria, 3
atrial arrhythmias, 137
atrial fibrillation, 406–412
arrhythmia therapy, 410–412
clinical presentation, 408
epidemiology and relevance, 407–408
general approach and therapeutic
aims, 409–410
pathology, 408–409
prevention, 412
therapeutic approach, 409–412
thromboembolic complications, 412
atrial septal defects (ASDs), 98
atrioventricular reciprocating tachycardia
(AVRT), 120
automated external defibrillators
(AEDs), 183
autonomic dysfunction, 156
autopsy-negative sudden unexplained
death (AN-SUD), 65, 72
β-adrenoceptors, 16
basal metabolic rate (BMR), 21–22
Bazett's correction, 116
beta-2 agonists, 472
bicuspid aortic valve disease (BAV), 198
clinical presentation, 253
exercise recommendations, 255
outcomes and management, 253–255
pathophysiology, 253
biphasic T-waves inversion, 108
biventricular pump failure, 218
black athletes
heart, 107
LV chamber dimensions in, 48
LVH and age and sex influence, 48–49
RV in, 49
T-wave inversion, 47–48
Bland–White–Garland (BWG)
syndrome, 275
blood flow control, 15–16
blood pressure, 156
blunt chest trauma
commotio cordis, 200
contusio cordis, 200
borderline response, 160
Borg perceived exertion scale, 157
bradycardia, 50
Brugada syndrome, 117–119, 303–313
AHA/ACC and ESC consensus
recommendations, 378
clinical presentation, 304–308
concept and epidemiology, 303
diagnostic criteria, 308–309
ECG, 305
electrocardiogram
exercise considerations, 311–313
genetic basis, 303–304
implantable cardioverter-defibrillator
(ICD), 309–311
management, 310–311
negative predictive value (NPV), 310
pharmacological tests and diagnostic
tools, 305–306
risk stratification, 309–310
stress ECG, 306–308
symptoms, 304
type 1 pattern, 117, 118
type 2 pattern, 118
B-type natriuretic peptide (BNP), 196
bypass pathway conduction, 120, 121
CABG, see coronary artery bypass
surgery (CABG)
capillary filtration, 13, 15
cardiac amyloidosis, 167–168
cardiac arrhythmia, 191
cardiac conditions predisposing to
sudden cardiac death
in sport, 191–201
cardiac cycle, 9–10
cardiac function
cycle, 9–10
heart sounds, 10
intrinsis and extrinsic regulation
of, 10–12
cardiac magnetic resonance imaging
(CMRI), 44, 207
cardiac mortality, 77–78
cardiac rehabilitation, 56
cardiac remodelling, 48, 49
cardiac sarcoid, 170–172
cardiac screening, 178
cardiac valve disease, 198
cardiomyocyte, 8–9
cardiomyopathies, 374–377
cardiopulmonary exercise testing
(CPET), 159
cardiorespiratory
capacity, 54
fitness, 55
cardiovascular abnormalities, 76, 77
cardiovascular concerns, paralympic
athlete, 475–482
autonomic dysfunction, 477
autonomic dysreflexia, 477–479
boosting, 479–480
congenital coronary artery disease (CHD),
481–482
deep venous thrombosis (DVT), 481
orthostatic hypotension, 477
Periodic Health Evaluation (PHE),
480–481
SCI, 475–480
team physician, considerations for,
480–482
cardiovascular disease (CVD)
genetic testing for
athlete, 182–185
inherited, 175–180
sudden death risk assessment,
180–181
identification of, 76
in older athlete, 449–455
physical activity, risk-benefit of,
449–450
preventing, 53–55
risk factors, 54
cardiovascular drift, 34
cardiovascular genetics evaluation, 180
cardiovascular magnetic resonance
athletes heart, 165
cardiac sarcoid, 170–172
coronary artery disease
atherosclerotic, 172
congenital coronary artery
anomalies, 172
hypertrophic cardiomyopathy (HCM),
165–167
LVH, causes of
ARVC, 169–170
cardiac amyloidosis, 167–168
dilated cardiomyopathy, 168
Fabry's disease, 167
LVNC, 170
myocarditis, 170
cardiovascular responses
aerobic exercise
blood flow distribution, 34–36
gender differences, 39
ageing, 39–40
exercise onset
neural control of, 33–34
maximal exercise, 36–38
prolonged aerobic exercise, 34
static exercise, 40–41
cardiovascular risk, PPE in
American Heart Association (AHA),
82–83
considerations, 91–93
European Society of Cardiology
(ESC), 84–85
Fédération Internationale de Football
Association (FIFA), 85
five protocols, comparison of, 85–91
4th monograph, 83–84
International Olympic Committee
(IOC), 85
cardiovascular system
atherosclerotic disease, prevention and
management of, 53–60
athlete's heart, 43–51
cardiovascular responses, exercise,
32–41
energy production pathways, exercise,
21–30
heart, anatomy and physiology, 3–12
vascular system, 13–20
emergency cardiac care

electron transport chain, 22–23

electrocardiogram (ECG), 7, 46, 71
electrical conduction
electrical conductance pathway, 6, 7

electrical abnormalities, 219

exertional heatstroke (EHS) see Ehlers–Danlos syndrome (EDS), 199

exhaustion

exercise roles, 143–144

novel echocardiographic indices, 137–143

pre-echocardiographic information, 128–130

standard echocardiographic examination, 130–137

Ehlers–Danlos syndrome (EDS), 199

EHS. see exertional heatstroke (EHS)
electrical abnormalities, 219
electrical conductance pathway, 6, 7
electrical conduction

action potentials and pacemaker cells, 6

conduction, 6–7

12-lead ECG, 7–8
electrical remodelling

in adolescent, 44–45

African/Afro-Caribbean ethnicity, 46–48

in female, 46

heart, 43

sporting discipline, 50
electrocardiogram (ECG), 7, 46, 71

abnormal electrical findings, 114

abnormalities, 100, 209

Brugada syndrome, 117
cardiac screening, 76
clinical questionnaires/

examinations, 128
demonstrating IRBBB, 98, 99

flow chart of, 104, 105

interpretation, 104
diagnostic utilisation, 161

exercise test-induced arrhythmias, 160–161

ST Depression, 160, 161

ST-segment elevation, 160, 161

in isolation, 101

long QT syndrome, 116

phenotypes, cardiomyopathy, 112

QT interval, 114

Q-waves, 108

recording

lead systems, 157–158

post-exercise period, 159

procedures, 158–159

processing, 158

protocols, 159

skin preparation, electrodes and cables, 157

ventilatory gas-exchange responses, 159
electron transport chain, 22–23

emergency cardiac care

communications, 488
definitive cardiac critical care, 490

epidemiology, 485
equipment, 487–488

onsite emergency cardiac care protocol, 489–490

personnel, 486–487

planning, 486

post-SCA debrief, 490–491

training, 486

transport, 490

emergency-service responders, 71

diastolic volume (EDV), 32, 43

diastolic wall stress, 12

diastolic shear stress, 18

diastolic volume (ESV), 32

deranged training, 29–30, 40. see also training effect

energy production pathways

energy sources, measurement of, 27–29

interacting energy systems, 23–27

primary sources, 21–23

training effect, 29–30

enhanced vasodilatory responsiveness, 56

ESC. see European Society of Cardiology (ESC)
estimated athlete denominator, 67

ethnicity, 46. see also athlete's heart

European Association of Cardiovascular Imaging (EACVI), 165

European Society of Cardiology (ESC), 75, 84–85, 100, 182, 234

Consensus Recommendations, 373
guidelines, 82

excess post-exercise oxygen consumption (EPOC), 28

exercise

intensity, 25, 27

physiology, 153–154

rehabilitation, 56–57

roles, 143–144

test-induced arrhythmias, 160–161

exercise-induced arterial hypertension (EIAH)

peak of exercise, 431

submaximal exercise, 431

exercise rhabdomyolysis (ER), 367–368

exertional heatstroke (EHS), 365–367

epidemiology of, 366

pathophysiology, 366–367

predisposing factors, 365–366

prevention, 367

recognition and management, 367

exercise-related events

medication considerations, 57

warm-up and cool-down, 57

extrasystoles, 112

extreme environmental conditions, 368

Fabry's disease, 167

false-positive ECG conundrum, 79

false-positive rate, 91, 92

family history considerations, 91–92

family screening, 183–184, 214

fatal rhabdomyolysis, 200

Fédération Internationale de Football Association (FIFA), 75, 85

fibro-fatty replacement, 217, 219

Fick principle, 36

FIFA Medical Assessment and Research Centre (F-MARC), 85, 87

first-degree atrioventricular (AV) block, 96, 97

five protocols, comparison of, 85–91

flat T-Waves inversion, 107–108

force-velocity test, 27

fossa ovalis, 4

4th monograph. see pre-participation physical evaluation monograph

4th edition

Frank-Starling mechanism, 32, 39
gadolinium chelates, 164
gastrointestinal tract (GIT), 36
genetic counselling, 180, 183
genetic mutations, 206
genetics evaluation, 180, 181

genetic testing

in athletes, 185

interpretation, 178–180

performance and injury, 184–185

glycogen-shunt hypothesis, 23–24

glycolysis, 22

gross cardiac anatomy

chambers, walls and valves, 3–5
coronary circulation, 5
tissue layers, 5
growth factors and related substances, 471–472

haemodynamics, 19–20

Harris–Benedict equation, 21

HCM. see hypertrophic cardiomyopathy (HCM)

heart, anatomy and physiology

cardiac function

cycle, 9–10

heart sounds, 10

intrinsic and extrinsic regulation of, 10–12

cardiomyocyte, 8–9
electrical conduction

action potentials and pacemaker cells, 6

conduction, 6–7

12-lead ECG, 7–8
gross cardiac anatomy

chambers, walls and valves, 3–5
coronary circulation, 5
tissue layers, 5

heart block, 124–125

heart chambers, 3, 4

heart muscle disorders

ARVC, 196–197

dilated cardiomyopathy (DCM), 197–198

hypertrophic cardiomyopathy (HCM), 194–195

idiopathic LVH, 195–196

myocardial fibrosis, 196

myocarditis, 198

stress cardiomyopathy, 198
heart rate, 33, 155–156
heart sounds, 10
high-altitude cerebral oedema
(HACO), 368
high-altitude pulmonary oedema
(HAPO), 368
high-amplitude J-point notching,
368
high‐amplitude J‐point notching,
368
high‐risk symptoms, 91–92
His–Purkinje system, 124
Human Genome Project, 178, 184
hypertension, 427–437
abnormal blood pressure response,
431–432
aetiology, 435
ambulatory blood pressure
monitoring, 430
antihypertensive drug, 436–437
arterial hypertension, 428
AHA/ACC guidelines and ESC
consensus recommendations, 381
blood pressure, 427–428
blood pressure response to
exercise, 431
cardiovascular risk stratification, 434
drugs, 433
epidemiology, 427
home blood pressure monitoring, 430
hypertensive athlete, 432–433
isolated systolic hypertension,
428–429
management of, 435–437
nonpharmacological treatment, 435
office blood pressure measurement,
429–430
out‐of‐office blood pressure
measurement, 430
in paralympic athletes with spinal cord
injuries, 433
pharmacological treatment, 435–436
physical examination of, 434
sports participation, 437
target organ damage, 434–435
white‐coat hypertension and masked
hypertension, 429
hypertrophic cardiomyopathy (HCM),
44, 47, 65, 130, 165–167, 441
athlete’s heart, differentiation from,
209–210
AHA/ACC guidelines and ESC
consensus recommendations, 375
diagnosis, 206–208
electrocardiogram abnormalities, 209
epidemiology, 205–206
genetics, 206
left ventricular outflow tract (LVOT)
obstruction, 209
management considerations,
211–214
natural history and clinical course,
210–211
T‐wave inversion, 47
hypoplastic coronary artery, 277
ICDs. see implantable cardioverter‐
defibrillator (ICD)
idiopathic ventricular fibrillation, 126,
148, 337–338
definitions, 331
excluding structural heart disease,
337–338
management, 338
idiopathic ventricular tachycardia,
331–333
athlete, 333–334
case report, 332–333
definitions, 331
excluding structural heart disease,
334–336
management, 336
implantable cardioverter‐defibrillator
(ICD), 74, 181, 232, 415–424
arrhythmogenic right ventricular
cardiomyopathy (ARVC), 419
automated external defibrillator,
423–424
Brugada syndrome, 420
catecholaminergic polymorphic
ventricular tachycardia (CPVT), 420
complications of, 421–422
diagnosis, 418–421
ethical and medicolegal
considerations, 421
extracorporeal shockwave lithotripsy
(EESWL), 424
hypertrophic cardiomyopathy
(HCM), 419
inappropriate shocks, 423
lead failure, 422–423
long QT syndrome, 419–420
magnetic resonance imaging (MRI),
424
nature of sport, 421
nonmedical equipment, 424
pocket complications, 422
short QT syndrome, 420–421
and sports, 228229
structure and function,
415–418
subcutaneous ICDs, 418
incomplete right bundle branch block
(IRBBB), 97–99
inferior T‐wave inversion, 107–108
inherited and congenital cardiovascular
pathologies
arrhythmogenic right ventricular
cardiomyopathy (ARVC),
217–229
hypertrophic cardiomyopathy (HCM),
205–215
inherited CVD
genetics of, 175–178
 genetic testing for, 178–180
insurance claims, 66
interacting energy systems
lactate kinetics, 24
phosphocreatine (PCr) and glycolysis,
sprint(s), 24, 25
VO2 responses
on exercise intensity, 25–27
submaximal exercise, 25
International Olympic Committee
(IOC), 75, 85, 86, 104
international task force criteria, 219,
222–223
intraventricular conduction
abnormalities, 109–110
IOC. see International Olympic
Committee (IOC)
ischaemic heart disease, 380–381
isometric contraction, 40
isovolumic contraction, 10
Israel experience, 78
Italian experience, 77–78
Italian Olympic Committee, 79
Italian screening protocol, 78
J‐point elevation, 100, 106, 147, 148.
see also early repolarisation (ER)
junctional escape rhythm, 96
juvenile ECG pattern, 44, 45, 106
J‐waves, 98
Katch–McArdle equation, 21
lactate kinetics, 24
lactic anaerobic pathways, 27
laminar flow, 18
Laplace law, 11–12
late gadolinium enhancement (LGE),
164, 208
lateral T‐wave inversion, 107–108
Lausanne recommendations,
85, 86
LBBB. see left bundle branch block
(LBBB)
lead systems, 157–158
left and right atria, 136–137
left bundle branch block (LBBB), 98,
99, 109, 233
left dominant ARVC variant, 221
left ventricle (LV)
cardiac mechanics, 138
cavity dilatation, 45, 46
cavity dimension, 45, 46
chemotherapy, 140
chronic cardiac adaptation, 130
concentric hypertrophy, 133
diagnostic algorithm, 133
global ejection fraction, 130
global longitudinal strain, 138
HCM heart, 138
hypertrabeculation, 130, 131
parasternal long‐axis orientation, 131
Simpsons bpline methodology, 133
strain profiles, 138–140
systole, 138
twist, 141
wall thickness measurements,
131, 132
left ventricular end‐diastolic dimension
(LVEDD), 168
left ventricular geometry, 131, 133
second-degree atrioventricular (AV) block, 96, 98
sedentary behaviour, 53
sedentary vs. untrained individuals, 39, 40
septal myocardial velocities, 131, 132
short QT syndrome, 117
sickle-cell disease, 200
sickle-cell trait (SCT), 361–365
athletic performance, 362
exercise collapse associated with, 363–364
exertional sickling, 364–365
pathophysiology of, 362–363
prevention, 364
risk factors, 364
sudden death, 362
single coronary artery, 277
single-lead ECG, 7, 8
sinoatrial node (SA), 4, 6
sinus arrhythmia, 95–96
sinus bradycardia, 95, 123–124
sinus node dysfunction, 95–96
sinus rate, 120
skin preparation, 157
smoking, 56
snake oil, 184
sodium channels, 117
sports cardiology training
assessment and evaluation, 501
cardiovascular mortality and morbidity, 496–497
cardiovascular-related symptoms, 497–498
cause sudden cardiac arrest (SCA), 498
cardiovascular adaptations to, 496–497
environment and infrastructure, 498
learning and assessment, 498–501
lectures and coursework, 498–500
mentored research, 501
physical activity, 496
pre-participation cardiovascular screening, 497
programme, 496
regular exercise, physiologic
scientific meetings, 501
supervised clinical experiences and procedural training, 500
sports eligibility, 228
sports-related SCD, 65
standard echocardiographic examination
coronary ostia, 137
left and right atria, 136–137
left ventricle, 130–133
right ventricle, 134–136
Starling law, 10
ST elevation, 98, 150, 151
stress, 52, see also post-surgery
stimulators, 472
strain imaging, 137–138
stress cardiomyopathy, 198
stress-perfusion CMR, 164–165
stroke volume, 33, 34, 37, 43
structural remodelling in adolescent, 45
African/Afro-Caribbean ethnicity, 48–49
male vs. female, 46
sporting discipline, 50
QT-segment, 117, 147
depression, 107–108, 160, 161
elevation, 47, 48, 106, 160, 161
subtle right ventricular structural changes, 217
sudden cardiac arrest (SCA), 114
incidence of, 120
type 1 Brugada pattern, 117
sudden cardiac death (SCD), 43, 44,
175, 211–212, 231, 232, 247
cardiovascular screening for cardiac disease risk, to identify,
76–77
on cardiac mortality, 77–78
competitive athletes, 75
costs, Italy, 78–79
implemented in Italy, 75
limitations of, 79–80
risk, 74–75
12-lead ECG, in PPE, 76
incidence and aetiology of aetiology of, 71
athletes vs. non-athletes, 71
higher risk for, 67
incidence of, 66–71
numerator and denominator, 65–66
relative frequency of, 71
in sport
aortic dissection, 199–200
blunt chest trauma, 200
cardiac valve disease, 198
conduction system, 199
coronary arteries disorder, 191–194
heart muscle disorders, 194–198
morphologically normal heart, 198–199
sickle-cell disease, 200
sudden death risk assessment, 180–181
sudden death syndromes, 126
catecholaminergic polymorphic ventricular tachycardia, 126
idiopathic ventricular fibrillation, 126
sudden infant death syndrome, 200
supraventricular tachycardia (SVT), 122,
247, 315
sympathetic activation, 41
sympathetic nervous system, 11
chest pain, 390–393
exertional fatigue and performance decline, 393
general considerations, 385–386
palpitations, 389–390
syncope, 380–389
syncope, 117
systemic circulation, 3, 13–15
systolic blood pressure (SBP), 33, 34,
37, 41
Takotsubo syndrome, 198
Tay–Sachs disease, 175
thoracic aortic aneurysm and dissection (TAAD), 199–200, 245
three-dimensional (3D) ultrasound imaging, 142–143
time of death, activity, 66
tissue Doppler imaging (TDI), 130
tissue layers, 5, see also heart, anatomy and physiology
T1 mapping, 164, 167, 171
trabeculae carnaee, 4
training effect
anaerobic energy production, 29
endurance, 29–30
oxidative phosphorylation, 29
transient atrial fibrillation, 58
transoesophageal echocardiography (TOE), 250
transthoracic echocardiogram (TTE), 166, 169, 250
treadmill test termination, 156
triangle of dysplasia, 221
tricuspid valve, 4
troponin I (TNNI), 206
troponin T (TNNT), 206
T-wave inversion, 44, 45, 100,
106–108, 209
in adolescent black athletes, 48
in adult female black athletes, 48
in adult male black athletes, 47
anterior, 106–107
flat/biphasic, 108
inferior, 108
lateral, 108
T2-weighted imaging, 171
12-lead electrocardiogram (ECG), 43
pre-participation screening, 82
primary electrical diseases, 114
2D echocardiography, 44
two-dimensional (2D) Doppler, 130
uncertainty, 65. see also numerator and denominator
Union Cycliste Internationale (UCI), 75
Union of European Football Associations (UEFA), 77
US Registry for Sudden Death in Athletes (USRSDA), 72
US vs. European guideline recommendations, 212–214
U-wave, 116
vagal tone, 43
vagal withdrawal, 155
Valsalva manoeuvre, 122
valvular disease, 247–261
aortic valvular disease, 253–257
basic principles, 247–253
haemodynamic changes with exercise, 251–252
medical therapy, 252–253
mitral valvular disease, 257–260
pathophysiology, 247–249
prevalence and causes, 247
prosthetic valves, 260–261
right heart valvular disease, 260
valvular heart disease, diagnostic approach to, 249–251
valvular heart disease (VHD), 383
variant of uncertain significance (VUS), 206
vascular system
  blood flow control, 15–16
  circulatory systems, 13
  haemodynamics, 19–20
  local regulating mechanisms, 17
  lymphatic system, 15
  neural regulation, 16
  nitric oxide, 17–18
  systemic circulation, 13–15
  vasodilator function, mechanisms, 18–19
  vasoconstrictor activity, 16
  vasodilation, 17, 20
  vasodilator function, mechanisms, 18–19
Venetian disease, 224
venous circulation, 13, 14
ventilatory gas-exchange responses, 159
ventilatory oxygen uptake (VO2), 153
ventricular arrhythmias, 122–123
ventricular fibrillation, 219
ventricular pre-excitation, 112
ventricular pressure, 10
ventricular tachycardia, 219
verapamil, 211
vigorous activity, 57
visceral pericardium, 5
voltage criteria
  atrial enlargement, 110–111
  left ventricular hypertrophy, 108–109
  for QRS-axis deviation, 110–111
  right ventricular hypertrophy, 109
wall-motion abnormalities, 219, 223
warm-up, 57
Wenckebach, 124
Wolff–Parkinson–White (WPW) syndrome, 119–122, 199, 315–322
  aetiology, 315–316
  associated cardiac abnormalities, 316
  AHA/ACC guidelines and ESC consensus recommendations, 379
  clinical presentation, 316–318
  ECG, 316
  epidemiology, 315
  genetics, 316
  invasive evaluation, 318–319
  management summary, 322
  noninvasive evaluation, 318–319
  phenotype, 112
  risk assessment of, 318–320
  transcatheter ablation, 320–321
  World Anti-Doping Agency (WADA), 468
  World Anti-Doping Code, 468
  World Health Organization (WHO), 53, 108
WPW. see Wolff–Parkinson–White (WPW) syndrome