AAD therapy, for VF, 118. See also antiarrhythmic drugs
ablation procedure
   alternative energy sources for, 440
delivery of RF energy in, 93, 93
positioning of catheter in, 92, 92–93
ablation sites, anatomical location of, 433
ablation technology, 440–441
ablation therapy. See also radiofrequency ablation
   complications associated with, 130
ever early history of, 431
medication as adjunct to, 23
for ventricular arrhythmias, 130–131
for VT associated with cardiomyopathy, 120, 120, 121
abutilide, 21
ACC/AHA/ESC guidelines, for management of ventricular arrhythmias, 130–131, 133
ACC/AHA/North American Society of Pacing and Electrophysiology (NASPE) 2002 Guidelines, 142, 144
accessory pathways
   common site for, 61, 62, 63
electrocardiography of, 63
radiofrequency ablation of, 67–71
action potential (AP). See cardiac action potential
action potential duration (APD), for sodium channel blockers, 18
Active Enguide, in NavX system, 437
adenosine
   for AVNRT, 55
   in AVRT, 67
   for pediatric SVT, 420
adolescents. See also pediatric patients
   follow-up care for, 406–408
ICDs in
   device selection for, 405
   implantation techniques for, 404
   indications for, 401, 403, 403–404, 404
pacemakers in
   implantation techniques, 399–400
   indications for, 397–399, 398
programming considerations in, 401, 402
adolescents (continued)
  SVT in, 412
  syncope in, 361
advance care planning, 458–459
advance directives (ADs), types of, 458
advanced practice nurses (APN), and pediatric patient with SVT, 420–421. See also nursing
AET. See atrial ectopic tachycardia
AF. See atrial fibrillation
AF ablation, 89–90
  delivery of RF energy in, 92–94, 92–94
  patient selection for, 90
  periprocedural anticoagulation for, 92
  postprocedural care and follow-up for, 95
  preprocedure care and preparation for, 90–92, 91, 91
  program quality data for, 91
afterdepolarization, delayed (DAD), 108, 108
afterdepolarization, early (EAD), 108, 108
afterload reduction therapy, for VT associated with cardiomyopathy, 118
afterpotentials, 149
age
  and causes of syncope, 362, 363
  heart failure and, 231
  and pacemaker programming, 215
air embolism, as complication of lead introduction, 168–169
aldactone, effect on pacing threshold of, 222
aldosterone, effect on pacing threshold of, 222
Alert Configuration Web site, 297
alert notifications, for ICDs, 273–274, 275, 275. See also recalls
allied health professionals. See also associated professional
  and atrial fibrillation, 98
  industry-employed, 463–464
ambulatory electrocardiographic monitoring systems, 26–27. See also specific systems
  event monitors, 29–30, 31, 32
  Holter monitor, 29
  implantable loop recorder, 30, 33
  mobile cardiac outpatient telemetry, 30
  ambulatory telemetry, in pediatric patients, 413, 414
ambulatory testing, in pacemaker follow-up
American Academy of Neurology, 367
American Autonomic Society, 367
American College of Cardiology (ACC), 117, 142, 377
American College of Cardiology/American Heart Association Task Force on Practice Guidelines, 397, 398, 403, 403
American Heart Association (AHA), 110, 117, 142
amiodarone
  for AF, 89
  antiarrhythmic actions of, 21
  dose-related adverse effects of, 426
  for pediatric patient with SVT, 421
  in pediatric SVT, 420
  for VT associated with cardiomyopathy, 118
amyloidosis, restrictive cardiomyopathy caused by, 112
analgesia
  distinguished from sedation, 444
  during implantation procedure, 166
anesthesia, for DFT testing, 171. See also sedation
angiotensin-converting enzyme inhibitors (ACEIs), for VT associated with cardiomyopathy, 118
angiotensin II receptor blockers (ARBs), for VT associated with cardiomyopathy, 118
anode, in pulse generator batteries, 145–146, 146
antiarrhythmic drugs (AADs), 23
  and action potential, 118, 118
  for AF, 89
  beta blockers, 21
  calcium channel blockers, 22
  classification of, 17
  potassium channel blockers, 21–22
  sodium channel blockers, 17–20, 18, 19
  in ventricular arrhythmias, 118
antiarrhythmics versus Implantable Defibrillators (AVID) Trial, 390, 390–391
antibiotics, during implantation procedure, 166–167
antibradycardia coding, 157
antibradycardia devices, 142, 155
antibradycardia pacing, NASPE/PBEG
generic code for, 155, 156
anticoagulation
for atrial fibrillation, 87–88, 88
CHADS score for, 88
prior to AF ablation, 92
antidromic reciprocating tachycardia (ART)
circuit of, 60, 60–61
dynamic maneuvers in, 66–67
in pediatric patients, 415, 417
antitachycardia devices, 142, 155
antitachycardia pacing (ATP), in ICD therapy, 120, 276
anxiety
of ICD partners, 317
in ICD patients, 312, 316
aortic stenosis (AS)
in pediatric patients, 403
syncope related to, 365–366
AP. See associated professional
arm sling, after implantation procedure, 172
arrhythmia, false, electrical activity and, 345
arrhythmia data, in device follow-up, 300–302, 302
arrhythmia episode, intracardiac recording of, 354
arrhythmia logs, 301, 302
arrhythmia patients
approach to, 25
physical assessment of, 27–28
arrhythmias, cardiac
causes of, 6
in children, 412
diagnosis of, 25–26
drugs for, 17
etiology of, 26
evaluation of
with ambulatory monitoring systems, 26–27, 28–29, 29–30, 31–33
cardiac CT, 35, 35
cardiac MRI, 35–36, 36
echocardiography, 34–35, 35
electrocardiography in, 26
exercise stress test, 36
with signal-averaged ECG, 30–32, 34
structural assessment of cardiac function in, 34–37, 35, 36
macrocirentant, 95
mechanisms of, 107, 107–108
symptoms of, 25–26
syncope related to, 362, 363
arrhythmogenic right ventricular
cardiomyopathy/dysplasia (ARVC/D), ICD implantation for, 176
arrhythmogenic right ventricular dysplasia (ARVD)
children with, 404
MRI in, 36
RVOT VT compared with, 131
SAECG in, 32, 34
and syncope, 364
arrhythmogenic right ventricular dysplasia/
cardiomyopathy (ARVD/C), 110
cardiac MRI image for, 116, 116
characteristics of, 113
SCD related to, 389
ARVD. See arrhythmogenic right ventricular
dysplasia
AS. See aortic stenosis
aspirin, for AF, 87–88, 88
associated professional (AP)
database maintained by, 328
and notice of recall, 329
patients notified of recall by, 330–331
role of, 327, 328, 333
atenolol, 21, 421
athletes, sudden cardiac death in, 364
atrial arrhythmia, device-determined, 345
atrial decoupling, 232
atrial ectopic tachycardia (AET)
in children, 412
in pediatric patients, 418, 418
atrial fibrillation (AF)
catheter-based ablation of, 433
catheter-based management of, 89–95, 90–94
in children, 419
classification of, 86
common drugs for, 17, 20
cost of, 86
diagnosis of, 87
atrial fibrillation (continued)
epidemiology and prevalence of, 85, 98
etiology of, 86, 86–87
heart failure associated with, 239–240
medical management of, 87–88, 88
rhythm control for
ECV, 88–89
PCV and maintenance of sinus rhythm, 89
risk factors for embolic events in, 87, 88
symptoms associated with, 87
team approach to, 98
atrial fibrillation (AF) log, with ventricular response, 271, 271
atrial flutter
atypical, 97, 98
ECG of, 96, 96
electroanatomical map of, 95, 97, 98
and pacemaker programming, 215
in pediatric patients, 415, 417–418
and pacemaker programming, 215
in pediatric patients, 415, 417–418
and pacemaker programming, 215
in pediatric patients, 415, 417–418
and pacemaker programming, 215
in pediatric patients, 415, 417–418
treatment of, 96, 97, 98, 98
types of, 95–96
atypical, 97, 98
atrial pacing, in CRT, 255, 255–256
atrial pacing threshold, automatic determination of, 211
atrial rhythm, in pacemaker follow-up, 207–208
atrial tachycardia
anatomy and physiology of, 72, 73
approach to, 76
automatic, 73, 82
case study, 80, 80–81, 81
clinical presentation, 72
common sites for, 73
diagnosis of
electrocardiographic, 72–73
electrophysiology in, 73–75, 75
differentiated from AVNRT or AVRT, 74
focal, 75
incidence of, 42
macrorreentrant, 72
mapping of, 435–436
pharmacological management of, 74
atrial tachycardia response (ATR), 269, 271
atrial threshold, in pacemaker follow-up, 209
atrioesophageal fistula (AEF), PVI associated with, 94
atrioventricular decoupling, 232, 233
atrioventricular reentry tachycardia (AVRT), in pediatric patients, 413
atrioventricular node. See AV node
automatic external defibrillators (AEDs), 389
automaticity, abnormal, 108
autonomic failure syndromes, 370–372
MSA, 371–372
PAF, 371–372
POTS, 370–371
autonomic nervous system (ANS)
disorders of, 379
functions of, 367–368
and noncardiac causes of syncope, 366–367, 367
and orthostatic intolerance, 367
and reflex syncope, 368–369
syncope and, 360
AV block, in pediatric patients, 397–398, 398
AVID clinical trial, 240, 241
AV nodal reentrant tachycardia (AVNRT), 41–42, 365
ablation for, 431
anatomy and physiology of, 43–44, 44
approach to, 76
case study, 76–77, 77, 78
circuit for, 45
common pathways in, 46
diagnosis of
clinical presentation in, 46–47
electrocardiographic characteristics in, 47, 47, 59
electrophysiological findings in, 48, 48–55, 50–54, 59
fast and slow pathways in, 44–45
inappropriate therapy for, 287, 288
incidence of, 42, 59
invasive electrophysiological management of, 56–59
noninvasive management of, 55–56
in pediatric patients, 412, 415, 417
simplified circuit of, 46
terminology for, 44–46
typical vs. atypical, 45
variants of, 46
AV node
anatomy of, 6, 7, 7, 8
autonomic innervation of, 9
blood supply of, 8
function of, 7
in radiofrequency ablation, 56
and slow pathway physiology, 8
AVNRT. See AV nodal reentrant tachycardia
AV reciprocating tachycardia (AVRT), 41
anatomy and physiology of, 59–63, 60, 62
approach to, 76
case study, 78, 79
clinical diagnosis of
  electrocardiographic, 63–64, 64
  electrophysiological findings in, 65, 65–67, 66
distinguished from AVNRT, 59, 63
ECG of, 416
incidence of, 42
noninvasive management of, 67
orthodromic, 59–60, 60, 78, 79
in pediatric patients, 424, 424, 425
radiofrequency ablation of accessory pathways
  selecting target for, 67–69
technique, 70
  unique accessory pathway locations in,
  70
terminology for, 59–63
AVRT. See AV reciprocating tachycardia
azimilide, 21

Bachmann’s bundle, 7
batteries
depletion of, 217
longevity of, 146
in pacemaker follow-up, 200, 206–207, 207
  for pulse generators, 145, 145–146, 146
battery status, determination of, 293, 294
battery voltage, for ICDs, 267
Bazzett’s formula, 133
bed rest, after implantation, 172
behavioral avoidance, in ICD patients, 313–314
beneficence, fostering, 454–455. See also ethical issues
beta blockers
  action of, 21
  in AVNRT, 56
  in patient with syncope, 379
  for VT associated with cardiomyopathy, 118
billing codes, for cardiac device monitoring, 278, 278
biofeedback, for patients with syncope, 378
biventricular capture, in CRT, 249, 251
biventricular pacing (CRT-P). See also cardiac resynchronization therapy
  mortality reduction related to, 119
target population for, 234
biventricular pacing system
chest X-ray of, 234, 236
components of, 234, 235
blanking period, 186
bleeding
  in pacemaker pocket, 220
  and pediatric SVT ablation, 423
blood pressure. See also orthostatic intolerance
dramatic swings in, 372
mechanisms of, 367, 367–368
Boston Scientific H125 CRT-P device, 254, 254
bradyarrhythmias
  as complication of implantation procedure, 174, 175
  pacemaker placement for, 142, 143
  syncope related to, 364–365
bradycardia counters, 254, 254
British Pacing and Electrophysiology Group (BPEG), 155
Brugada syndrome, 102, 127
case study, 36–37, 37, 137
diagnosis of, 128, 128, 135, 135
on ECT, 36, 37
  genetic mutation linked with, 134–135
  incidence of, 134
  management of, 135–136
  in pediatric patients, 365, 403–404
  SCD related to, 389
  syncope related to, 380, 381
bundle branch
  left, 6, 7, 9
  right, 6, 7, 9
bundle branch block, right, 403
bundle branch reentrant tachycardia, 103
bupivacaine (Marcaine®), in implantation procedure, 165

calcium channel blockers
  in AVNRT, 56
  characteristics of, 22

calcium channels, characteristics of, 9, 11

calcium ions, in cardiac action potential, 13, 13–14, 14, 15

calcium pump, 9, 10

can, the, 144

Canterbury v. Spence, 455

capacitors, in implantable cardiac devices, 153, 154

capture
  biventricular, 249, 251
  defined, 181
  failure to, 219
  loss of, 227
  problems with, 218–219
  right ventricular, 181, 182

capture problems, on pacemaker ECG, 197, 197

capture threshold testing, 307–308, 308. See also threshold testing
  in device follow-up, 306–308, 307, 308
  patient positioning during, 306
  ventricular, 307, 308

carbon dioxide monitoring, during procedural sedation, 448

cardiac action potential, 9–17, 10, 11, 12–16, 102, 106–107, 107
  and action potential of pacemaker cells, 14–17, 16
  phases of, 12–14, 12–15

cardiac compass report, 249, 250, 268

cardiac electrophysiology practice
  avoiding ethical dilemmas in, 464
  ethical issues
    advance care planning in, 458–459
    bedside allocation of health care resources, 462–463
    confidentiality, 461–462
    device advisories, 459–460
    fostering beneficence, 454
    IEAP relationships, 463–464
  obtaining adequate informed consent, 455–456
  promoting nonmaleficence, 455
  proper surrogate decision making, 459
  requests for interventions, 460–461
  withdrawal of device therapies, 456–458

cardiac implantable electronic devices (CIEDs), increasing use of, 453, 465. See also cardiovascular implantable electronic devices; specific devices

cardiac resynchronization therapy (CRT), 119, 161, 231
  and AF associated with HF, 239–240
  biventricular pacing, 234, 235, 236
  case studies, 249–258, 250–257, 257
  clinical trials, 234–236, 237–238
    CARE-HF, 238, 239
    COMPANION, 238, 239
    MIRACLE, 236, 237, 239
    MUSTIC, 236, 237
  electrical repositioning, 244, 246
  forced RV pacing and, 240
  goal of, 249
  implantation of, 242–244, 243
  indications for, 143, 144, 234, 235
  optimization of, 244, 245, 246
    AV and V-V optimization, 244–246
    diagnostic features, 246–248, 247
    in patients with advanced HF, 248
    for pediatric patients, 405–406
    responders and nonresponders, 248
  cardiac resynchronization therapy (CRT) devices
    components of, 144–154, 144–157, 156
    development of, 142
    faulty CRT-Ds, 327
    faulty CRT-Ps, 327
  cardiac rhythm devices. See also specific devices
    numbers for, 161
    replacement of, 172
    successful implantation of, 174–175
  cardiac tamponade, as complication of implantation procedure, 173
  cardiomyopathies, 101, 113. See also dilated cardiomyopathy; hypertrophic cardiomyopathy
arrhythmogenic right ventricular dysplasia, 113
causes of, 109–110
classification of, 110, 111
definitions of, 109
mortality associated with, 113, 114
nonischemic, 112
and pacemaker programming, 216
patient management in
cardiac MRI, 117
echocardiogram, 114, 116, 116
event monitor, 117
Holter monitor, 116–117
12-lead ECG, 114, 115
physical examination, 113
signal-averaged ECG, 117
T wave alterans, 117
with underlying coronary artery disease, 117
restrictive, 110, 112–113
risk stratification process for, 113, 114
SCD related to, 388, 388–389
tachycardia-induced, 422, 425
and ventricular arrhythmias, 102, 104
cardiopulmonary resuscitation. See CPR
cardiopulmonary disease (CVD) as leading cause of death, 101, 121
syncope related to, 362, 363
cardiopulmonary exam, 374–375
ventricular tachycardia on, 434
CARTOMERGE software, 433
carvedilol, 21
case studies atrial tachycardia, 80, 80–81, 81
AVNRT, 76–77, 77, 78
AVRT, 78, 79
Brugada syndrome, 36–37, 37
CRT, 249–258, 250–257, 257
device evaluation, 352–354, 352–354
ethical issues, 454–463
implantation procedures, 175–177
with pacemaker patients, 222–230, 223, 224, 226–230
in pediatric SVT, 424, 424–426
psychosocial issues for ICD patients, 121, 122
CASH clinical trial, 240, 241
catecholaminergic polymorphic ventricular tachycardia (CPVT) children with, 404
SCD related to, 389
catecholamines, action of, 21
catheter ablation, of VT, 120, 120–121
cathode, in pulse generator batteries, 145–146, 146
cefazolin, during implantation procedure, 167
central nervous system (CNS), 367
cephalic vein cut down, 174
CHADS score, 87, 88
Chagas disease, 113
channelopathies, SCD related to, 389
chest X-ray (CXR) after implantation procedure, 172, 174
in ICD device follow-up, 279
of ICD lead dislodgement, 284, 284, 286, 287
during implantation procedure, 168
lead and pacemaker position in, 230
in pacemaker follow-up, 214
in pediatric patients, 408
children. See also pediatric patients with congenital AS, 365–366
CRT for, 405–406
follow-up care for, 406–408
children (continued)

ICDs in

device selection for, 405
implantation techniques for, 404
indications for, 401, 403, 403–404, 404

pacemakers for, 215, 216
device selection, 400
implantation technique, 399–400
indications for, 397–399, 398
programming considerations in, 401, 402

syncope in, 361

CIDS clinical trial, 240, 241
CIEDs. See cardiovascular implantable
electronic devices
circuitry, in implantable cardiac devices, 153,
153–157, 154, 156

clinical trials. See also specific clinical trials

AVID, 390, 390–391
CARE-HF, 238, 239
CASH, 240, 241
CIDS, 240, 241
Contak CD, 237, 242
CRT, 248
DEFINITE, 241, 242
ICD therapy and SCD, 241–242
MADIT I and II, 241, 242
MIRACLE, 236, 237, 238, 239, 242, 244, 276
MUSTIC, 236, 237
MUSTT, 119, 241, 242
PainFREE I and II, 276
PATH-CHF, 237
PAVE, 239–240
SCD-HeFT, 119, 390, 391

common bundle, 8

COMPANION clinical trial, 238, 239, 242
complex fractionated electrogram (CFE) maps, 439

compression stockings, for patients with
syncope, 378

computed tomography (CT)
cardiac, 35, 35
CARTO mapping system and, 433
and NavX mapping and navigation system, 437, 439

prior to ablation procedure, 91, 91

conducting cells, 9

conduction, cardiac
abnormal, 6
action potential in, 102, 106, 107
anatomy of, 5–9, 6
pacing rates associated with pacing sites
within, 7

conductors, in pulse generators, 147

confidentiality issues, 461–462
congenital complete AV block (CCAVB), 398,
398–399

congenital heart block, long-term pacing in
patients with, 220

congenital heart disease
pacemaker programming in, 216
and ventricular arrhythmias, 102, 104

Contak CD clinical trial, 237

contraction, cardiac, 5

coronary arteries, anomalous, syncope related
to, 364
coronary artery disease (CAD)
in cardiomyopathy, 117
echocardiography in, 35
ICD therapy and, 379–380
SCD related to, 387–388, 388
and ventricular arrhythmias, 102, 104
coronary bypass surgery (CABG), ICD
implantation following, 150
coumadin. prior to AF ablation, 92. See also
anticoagulation
counseling, for pediatric patients,
406–407
CPR (cardiopulmonary resuscitation)
advances in, 387
for family members of pacemaker-
dependent children, 406
critical event experience, of ICD patients,
319
cross talk, 191, 192

CRT. See cardiac resynchronization therapy
cryoablation
for cardiac arrhythmias, 440
for pediatric patients, 420
radiofrequency compared with, 58
cryomapping, ablation and, 71
database
  in device recall
    fields for, 328
    of potentially involved patients, 329–330
    and potential for recall, 328
DCM. See dilated cardiomyopathy
decremental pacing, 54
defibrillation system, three-patch, 151, 151
defibrillation threshold (DFT)
  in CD device follow-up, 276
  documentation of, 163
  testing during implantation, 170–171
Defibrillators in Nonischemic
  Cardiomyopathy Treatment Evaluation (DEFINITE), 119
defibrillatory shock
  in device evaluation, 343
  on ECG, 337
DEFINITE clinical trial, 241, 242
dehydration, risk of, 173
delayed afterdepolarization (DAD), 108, 108,
  129, 129
delta waves, in WPW, 413, 416
depolarization
  atrial, 7
  cardiac, 7, 9
  in cardiac action potential, 12, 12
  of pacing cell, 16–17
  and role of pacing cells, 9
  ventricular, 102
depression, in ICD patients, 313
device advisories, and ethical issues, 459–460
device evaluation, 351
  acute presentations
    emergency department, 336–337, 339–340
    office presentation, 336, 337, 338
    remote monitoring, 338–340, 341–343
  case studies, 352–354, 352–354
  goal of, 335
  history in, 335
  periprocedural, 340–341, 344
    ESWL, 347–348
    radiation therapy, 344, 346
    surgical electrocautery, 341, 344, 345
  TENS, 346–347
  VADs, 348–349
  postmortem, 349, 349, 350, 351
device follow-up, 293. See also pacemaker follow-up
  concluding patient encounter in, 309
  documentation of, 309–310
  ending interrogation in, 308–309
  gathering and reviewing data
    diagnostic data, 298
    patient history, 297–298
  initial interrogation in, 298, 299
  performance data
    arrhythmia, 300–302, 302
    heart failure, 300, 300, 301
    heart rate, 299, 299–300
    lead performance, 298–299
    percent of pacing, 298
  printing and reviewing EGMs, 303, 303–304,
    304
  remote monitoring, 295
  scheduling for, 295
  testing in, 304–305
    capture threshold testing, 306–308, 307, 308
    impedance testing, 305
    sensing thresholds, 305–306
  tracking patients, 296–297
  types of, 293–295
device recall. See recalls
device therapies. See also cardiac electrophysiology practice
  and advance care planning, 458
  futility of, 461
  managing withdrawal of, 456–458
  patient refusal of, 457
  in pediatric patient, 408
  and surrogate decision making, 459
device therapy indication classes, 453
dexmedetomidine (Precedex®), during implantation procedure, 166
Diagnostic and Statistical Manual-IV (DSM-IV) criteria, 313
Diagnostic Landmarking tool, of NavX mapping system, 437–438, 438
differential site pacing, 54
digital storage systems, for ICDs, 267
digoxin
  in AVNRT, 56
  for pediatric patient with SVT, 421
dilated cardiomyopathy (DCM), 110, 112
  CRT for, 258, 258
  echocardiogram in, 111
  electromechanical dyssynchrony in, 232–234
  SCD related to, 388
  and syncope, 364
diltiazem, 22, 421
direct current cardioversion (DCCV), case study in, 122
discharge instructions, for patients with ICD, 290
disopyramide, 18, 222
diuretics
  in CRT, 249, 253
  for VT associated with cardiomyopathy, 118
documentation
  of device follow-up, 309–310
  of hardware during implantation, 163
  in ICD follow-up, 277
  of procedural sedation, 450
dofetilide, 21, 22, 421
do-not-resuscitate (DNR) order, pacemaker in, 216–217
dronedarone, compared with amiodarone, 21–22
dual AV nodal physiology, of AVNRT, 48–49, 48
dual-chamber pacing, 188–188
  nontracking mode, 190
  rate-responsive modes, 190
  tracking modes, 189, 189–190
durable power of attorney, 458
Dynamic Substrate Mapping (DSM) program, 436
dysrhythmias, syncope related to, 364–365. See also arrhythmias
earliest atrial activation, in AVRT ablation therapy, 79
earliest ventricular activation, in AVRT ablation therapy, 79
ECG
  antiarrhythmic drug effects on, 17, 19
  of AP-mediated SVT, 416
  in Brugada syndrome, 36, 37, 135, 135
  drug effects on, 17, 18
  from pacemaker check, 224
  signal-averaged (SAECG), 30–32, 34
ECG, baseline, in pacemaker follow-up
ECG, 12-lead
  in cardiomyopathy, 114, 115
  in pediatric patients with SVT, 413
  pre-excitation on, 64
  of RVOT, 131, 132
ECG, pacemaker
  capture problems, 197, 197
  interpretation of, 194–198, 195, 196, 197
  sensing problems, 195–197, 196
ECG (Holter) monitor, ambulatory, 29. See also Holter monitor
echocardiography
  assessment of left atrial size by, 35
  in evaluation for arrhythmia, 34–35, 35
ectopic atrial tachycardia, mapping and ablation for, 435
effort intolerance, in device evaluation, 335
elderly
  falls in, 360
  syncope in, 360, 364
  AS and syncope in, 366
elective replacement indicator (ERI), 407
elective replacement indicator (ERI) voltage, 267
electrical-based therapy, in patients with advanced HF, 248
electrical cardioversion (ECV), for atrial fibrillation, 88–89
electrical network, of cardiac system, 5
electrocardiogram. See ECG
electrocardiography
accessory pathway related, 63
in AVNRT, 47, 47, 59
in evaluation of arrhythmias, 26
electrocautery, surgical, 341, 344, 345
electrodes, in pulse generators, 148–150, 149
electrogram (EGM), 50–54
during AVNRT, 50, 51
in device follow-up, 303, 303–304, 304
in ICD diagnostics, 267, 269
during radiofrequency ablation, 57, 57
real-time, 267, 269
during tachycardia, 52, 53
electrogram (EGM)-guided ablation, 90
electrolytes, 146
electromagnetical interference (EMI), 221–222
electromechanical dyssynchrony, 232
atrial decoupling, 232
atrioventricular decoupling, 232–233, 233
interventricular conduction delay, 234
IVCD, 234
LV mural delay, 234
electromechanical interference, case study, 281, 281–282, 282
electron delivery system, battery as, 145, 145
electronic medical record (EMR) systems, CD
documentation in, 277
electrophysiological disorders, and SCD, 389
electrophysiology
of AVRT, 65, 65–67, 66
basic cellular, 102, 106–107, 107
cardiac action potential, 9–17, 10, 11, 12–16
interventional, 431–432
pediatric, 400
electrophysiology (EP) laboratories
mapping systems used in, 431–432
procedural sedation in, 443–451, 445, 447, 449
electrophysiology practice. See cardiac electrophysiology practice
electrophysiology study (EPS)
in pediatric patients, 420
in VT in structurally normal heart, 130–131
embolism, as complication of lead introduction, 168–169
emergency department (ED)
device evaluation in, 337–338, 339–340
syncope patients in, 360
emergency equipment, for procedural sedation, 446, 447
EMPIRIC clinical trial, 276
endocardial VT ablation, 121
end of life (EOL)
and ICD deactivation, 457
pacemaker use in, 216
and surrogate decision making, 459
EnSite Array noncontact system, 436
EnSite mapping system
EnSite array catheter, 435–436
introduction of, 434
limitations of, 436, 439–440
NavX mapping and navigation, 436–440, 438, 439
epicardial leads, 151, 151
epinephrine, action of, 21
episode counter report, in CRT, 249, 250
episode counters, in ICD diagnostics, 267, 270
episode length, in arrhythmia logs, 301
EPS, in select patients with syncope, 377
esmolol, in AVNRT, 56
ESWL. See extracorporeal shock wave lithotripsy
ETCO₂ monitoring, during procedural sedation, 448
ethical issues, in cardiac electrophysiology practice
advance care planning in, 458–459
bedside allocation of health care resources, 462–463
confidentiality, 461–462
device advisories, 459–460
fostering beneficence, 454–455
with IEAPs
obtaining adequate informed consent, 455–456
promoting nonmaleficence, 455
proper surrogate decision making, 459
requests for interventions, 460–461
withdrawal of device therapies, 456–458
Index

ethics
  avoiding dilemmas of, 464
  and implantable cardiac devices, 453
  principles of, 454, 454
ethics consultation, 465
European Society of Cardiology Working Group on Myocardial and Pericardial Diseases, 110
euthanasia, 457
event log, 269, 270
event (or loop) monitor, 29–30, 31, 32
  in cardiomyopathy, 117
  in evaluation of arrhythmias, 28
  in pediatric patients, 413, 414
  event recording
    in pacemaker follow-up, 214
    in syncope evaluation, 376
exercise stress testing, 36
  chest X-ray in, 214
  in pacemaker follow-up, 214
  in pediatric patients with SVT, 413
  in syncope evaluation, 376
explantation, due to device advisories, 459–460
extracorporeal shock wave lithotripsy (ESWL), 347–348
falls, syncope related to, 360–361
families, of ICD patients, 311
far-field sensing, pacemaker problems with, 218
fasciculoventricular tracts, 63
fast VT (FVT) zone, 276
fatigue, in device evaluation, 335
fentanyl (Sublimaze®), during implantation procedure, 166
fluoroscopy
  during ablation procedures, 431
  during implantation procedure, 162, 168
follow-up. See device follow-up; pacemaker follow-up
Fontan procedure, 399, 401
Food and Drug Administration (FDA), recall defined by, 327–328
forced RV pacing, 240
Framingham Study, 87, 360
“frozen shoulder,” in pacemaker follow-up, 221
fusion beat, in pacemaker capture, 181, 182
FVT events, case study, 282–284, 283

genetic arrhythmia syndromes, VT associated with, 136
genetic disorders. SCD related to, 389. See also Brugada syndrome; long QT syndrome
Glen shunt, 399
head pulsations, in device evaluation, 335–336
head-upright tilt-table test (HUTT), 362, 364
  indications for, 377
  in syncope evaluation, 376–377
health care resources, inappropriate bedside allocation of, 462–463
heart block
  long-term pacing in patients with, 220
  and pediatric SVT ablation, 423
  sensing test in, 183, 183
  and syncope, 364
tachycardia with complete, 352
heart failure (HF), 101
  AF associated with, 239–240
  and Brady counters, 254, 254
  etiology of, 232
  incidence of, 231
  mortality associated with, 113, 114
  NYHA class IV, 232
  sudden death associated with, 240, 241–242, 242
  and ventricular arrhythmias, 102, 104
heart failure (HF) data, in device follow-up, 300, 300, 301
heart partners, 311. See also partners of ICD patients
heart rate data, in device follow-up, 299, 299–300
Heart Rhythm Society (HRS)
and classification of AF, 86
policy statement on device reprogramming, 464
on withdrawing life-sustaining treatments, 457
hematoma, and pediatric SVT ablation, 423
hemodynamic status, in device evaluation, 336
Hippocrates, 359, 364
His bundle, 8
His-Purkinje system conduction disease, 112
histograms
in ICD diagnostics, 272, 273
rate, 203–204, 204
history, medical
in arrhythmias, 26, 27
in device follow-up, 297–298
in procedural sedation, 444
in syncope, 372–374, 373, 374
history of present illness (HPI), in evaluation of arrhythmias, 27
Holter monitor, 29
in cardiomyopathy, 116–117
in evaluation of arrhythmias, 28
in pacemaker follow-up
in pediatric patients, 413, 414
supraventricular tachycardia on, 257
in syncope evaluation, 376
homeostasis, 368
hospice care, and ICD implantation, 454
Hospital Anxiety and Depression Scale (HADS), 316
HUTT. See head-upright tilt-table test
hypertrophic cardiomyopathy (HCM), 110, 112
MRI of, 112
and pacemaker programming, 216
SCD related to, 388
syncope related to, 364, 366
in young athletes, 364
hypotension, as complication of implantation procedure, 173. See also orthostatic hypotension
hysteresis
on pacemaker ECG, 198
in pacemaker follow-up, 213
pacemaker interval timer for, 184
ICD patients
operant conditioning in, 314
partner concerns of, 314, 317
problems of
behavioral avoidance, 313–314
depression, 313
general anxiety, 312, 316
PTSD, 313
shock anxiety, 312–313, 316
psychosocial adjustment of, 321
psychosocial issues, 311
assessment of, 318–319
case studies, 321, 322
comons, 320
interventional approaches to, 319
QOL for, 314–315, 319–321
and role of spouses, 315, 317, 317
social support for, 315, 316, 317
ICD policy, 1993, 157
ICDs. See implantable cardioverter defibrillators
ICD therapy
for children, 401, 403, 403–405, 404
in patients with LQTS, 134
pharmaceutical agents with, 289
psychosocial implications of, 392
and SCD, 389–390, 390
for VT associated with cardiomyopathy, 118
for VT in structurally normal heart, 136
idiopathic left ventricular tachycardia (ILVT), 127
incidence of, 131–132
morphology of, 132–133
treatment options for, 133
idiopathic ventricular fibrillation, 37
idiopathic ventricular tachycardia, mechanisms of reentry, 129–130, 130
triggered activity, 129, 129
impedance testing, in device follow-up, 305
implantable cardiac devices. See also specific devices
growing popularity of, 335
indications for, 465
implantable cardioverter defibrillators (ICDs), 25
adverse events associated with, 392
case studies, 121–122
components of, 144–154, 144–157, 154, 154, 156
deactivation of, 457, 458
development of, 141–142, 143
device diagnostics, 267, 269, 269
  AF and ventricular rate (VR), 269, 271, 271
  alert notifications, 273–274, 275, 275
  battery voltage, 267
  episode counters, 267, 270
  heart rate histograms, 272, 273
  lead trending, 272, 273
  nonsustained events, 279
  percentage of pacing, 272, 272
  sensing integrity counter, 272–273, 274
treated VT/ventricular fibrillation (VF) episodes, 267, 269, 269
discharge instructions for, 290
documentation for, 277
and ESWL, 348
evaluation of, 335
faulty, 327
FDA approval of, 279
follow-up for, 279
intrinsic measurements, 276
lead dislodgement, 284, 284–287, 285, 287
pacing thresholds, 276
pocket infection in, 288–290, 289
programming, 276–277
remote, 277, 277–278, 278
routine, 265–267, 266
troubleshooting in, 278–279
increasing use of, 453, 465
interrogation, 267
recipients of, 162
and SCD, 240
success of, 265
for VT associated with cardiomyopathy, 119–120, 121
implantable loop recorders (ILRs), 30, 33, 362, 364
in evaluation of arrhythmias, 28
in syncope evaluation, 376
implantable pulse generator (IPG), 144
implantation
  complications associated with, 392
  immediately postoperative, 174
  perioperative complications, 173–174
  DFT testing procedure in, 170–171
  fluoroscopy during, 162, 168
  procedure
    analgesia during, 166
    case studies, 175–177
    for device replacement, 172, 176–177
    documentation of hardware in, 163
    facility for, 161–163, 162
    instrumentation for, 167
    intraoperative monitoring, 163–164, 164
    lead introduction and positioning in, 168–170
    patient preparation in, 164–165, 165, 166
    perioperative antibiotics, 166–167
    pocket site for, 167–168
    postoperative care for, 172–173
    for resynchronization devices, 171–172
    sedation for, 165–166
    training protocols for, 166
  venous access in, 168
  subpectoral, 163
implantation, pacemaker
  epicardial, 399
  for pediatric patients, 399
implant site, in device evaluation, 336
implant team, 161, 162, 162, 163, 175
industry-employed allied professionals (IEAPs), ethical issues with, 463–464.  
See also allied health professionals
infants. See also pediatric patients
ablation therapy for, 420  
epicardial dual-chamber ICD in, 404  
follow-up evaluation for, 407  
pacemaker implantation in, 400  
SVT in, 412
infection
ICD pocket, 289, 289–290  
of pacemaker pocket, 220  
risk during implantation procedure, 167
informed consent
essential elements of, 456  
obtaining adequate, 455–456
internal cardioverter defibrillator,
indications for placement of, 142, 143.  
See also implantable cardioverter defibrillators
internodal tracts, 6, 7
interrogation, in device follow-up, 298. See also pacemaker follow-up
interval plot, erratic ventricular rhythm on, 330
intervals, pacemaker, 181
interviewing techniques, in device follow-up, 297
intra-atrial reentrant tachycardia (IART), in pediatric patients, 415, 417–418, 418
intracardiac activation patterns, in AVNRT, 49, 50, 51
intracardiac echocardiography (ICE), in CARTO mapping system, 433
intravenous therapy, during implantation procedure, 164–165
intrinsic conduction, pacemaker, search algorithm for, 192–194
iodinated IV contrast, during implantation procedure, 164–165
ion channels, properties of, 9, 10
ion movement
in cardiac action potential, 9  
and negative intracellular voltage, 14, 15  
passive, 9, 10
ion pumps, 9, 10
ion transport
fundamentals of, 10
specific channels for, 11
ischemic heart disease, and pacemaker programming, 215–216. See also cardiovascular disease
isoproterenol, effect on pacing threshold of, 222
Joint Commission on Accreditation of Health Care Organizations (JCAHO)
on ethical concerns, 465
on procedural sedation, 443, 444, 451
training protocols of, 166
junctional ectopic tachycardia, in pediatric patients, 415, 419
junctional escape rhythm, tachycardia with, 352
junctional tachycardia
AVNRT as, 43  
defined, 41
Koch, triangle of, 8, 43, 44
laboratory tests, in syncope evaluation, 376
laser ablation, 440, 441. See also ablation therapy
lead components, of ICDs, 147, 147
connector, 153
CS leads, 152
design of, 148, 148
differences between pacing and ICD leads, 151–152, 152
electrodes, 148–150, 149
fixation mechanisms for, 150, 150–151, 151
implantation of, 151, 151
lead conductor fracture, abrupt, 340
lead dislodgement, 174
case study, 284, 284–287, 285, 287
late, 299
lead impedances
in ICD device follow-up, 274, 276
on pacemaker interrogation, 227, 229
leads
capture threshold of, 307
in device follow-up, 298–299
dislodgement of, 220
emergent replacement of, 230, 230
hardware problems with, 217
ICD compared with pacemaker, 286
insulation damage to, 218
in pacemaker follow-up, 200, 206
leads, during implantation, 168–170
localizing tips of, 170
securing tips of, 169–170
testing, 170
left anterior oblique (LAO) view, during implantation, 169
Left Ventricular-Based Cardiac Stimulation Post AV Nodal Ablation Evaluation (PAVE) trial, 239–240
left ventricular outflow tract (LVOT), 127, 137
left ventricular outflow tract ventricular tachycardia, 131
legal issues
life-sustaining treatment, 457
withdrawal of device therapies, 456
lidocaine (Xylocaine®)
classification of, 19
in implantation procedure, 165
LiI battery, 146
living will, 458
Local Activation Time (LAT) feature, in NavX mapping system, 438
long QT syndrome (LQTS), 102, 127
acquired, 134
children with, 403
EADs in, 129
genotypes of, 134
management of, 134
newborn with, 402
in pediatric patient, 365
SCD related to, 389
and syncope, 364
loop monitors, 30, 31. See also implantable loop recorders
in evaluation of arrhythmias, 28
indication for, 29
in pediatric patients, 413, 414

loss of conscious (LOC), syncope and, 362
Lovenox, prior to AF ablation, 92. See also anticoagulation
low ejection fraction, identification of, 34–35
low rate interval (LRI), 181, 184, 184
LQTS. See long QT syndrome
LVOT. See left ventricular outflow tract
LV thresholds, in CRT, 258, 258

MADIT I clinical trial, 241, 242
MADIT II clinical trial, 241, 242
magnet, applied to pacemaker, 174
magnetic resonance imaging. See MRIs
Mahaim (atriofascicular) fibers
ablation of, 71
nomenclature for, 63
Mallampati Scale, 445, 445
mapping systems
CARTO, 432–434, 434
electroanatomical nonfluoroscopic, 431–432
EnSite, 338, 339, 434–440
technique for noncontact, 435
maximum sensor rate (MSR), 181, 185
maximum tracking rate (MTR), 181, 185, 212–213
MCOT. See mobile cardiac outpatient telemetry
mechanoreceptors, 369
MedicAlert™, 406
medical history, in arrhythmias, 26, 27
Medical therapy, in cardiomyopathy with VT, 117–119, 119. See also pharmacotherapy
medications, in device follow-up, 297. See also antiarrhythmic drugs; specific medications
Medtronic, Atrial Capture Management of, 211
metoprolol, 21
Mexiletine, 19
midazolam (Versed®), in implantation procedure, 165–166
midodrine, in syncope, 379
MIRACLE (Multicenter InSync Randomized Clinical Evaluation) study, 236, 237, 238, 239, 242, 244, 276
mobile cardiac outpatient telemetry (MCOT), 29, 30, 32
mode switch
  in pacemaker follow-up, 213–214
  tracings for, 338
monitor, remote home, 277, 277
monitoring. See also remote monitoring
goals of ICD, 266, 266
during implantation, 163–164, 164
in pediatric SVT, 474
during procedural sedation
  blood pressure, 447
  cardiac function, 446–447
  ETCO₂, 448
  of level of consciousness, 449, 449
  pulse oximetry, 448
  supplemental oxygen, 448
MRIs (magnetic resonance images)
cardiac, 35–36, 36
  in cardiomyopathy, 117
  CARTO mapping system and, 433
  and NavX mapping and navigation system, 437, 439
MSA. See multiple system atrophy
MTR. See maximum tracking rate
Multicenter Automatic Defibrillator
  Implantation Trial I (MADIT I), 390, 391
Multicenter Automatic Defibrillator
  Implantation Trial II (MADIT II), 119, 390, 391
Multicenter Unsustained Tachycardia Trial
  (MUSTT), 119, 241, 242
multielectrode array catheter, for EnSite
  mapping system, 435, 436
multifocal atrial tachycardia (MAT), in
  pediatric patients, 415, 418, 419
multiple system atrophy (MSA), 370, 371–372
Mustard procedure, 401
MUSTIC (Multisite Stimulation in
  Cardiomyopathies) Studies, 236, 237
myocytes, cardiac, 9
myopotential
  on ECG, 196
  and pacemaker activity, 218
nadolol, in pediatric SVT, 421, 424
NavX mapping and navigation system,
  436–440, 438, 439
neck pulsations, in device evaluation,
  335–336
neonates, SVT in, 412. See also pediatric
  patients
neurally mediated syncope (NCS), 369
neurocardiogenic syncope (NCS), 360, 368, 368
newborn, long QT syndrome in, 402. See also
  pediatric patients
New York Heart Association (NYHA)
  classification, 113, 114, 232
  and CRT, 171, 235
  and SCD risk, 388–389
Nightingale, Florence, 359
noise artifact, inhibition of ventricular pacing
due to, 285, 285
nonmaleficence, promoting, 455
nonpacing cells, 9, 12
norepinephrine, action of, 21
North American Society of Pacing and
  Electrophysiology (NASPE), 155
  1993 policy statement of, 157
  2002 Guidelines of, 142, 144
nuclear magnetic resonance imaging, cardiac,
  36, 36
nursing
  and implantation procedure, 162–163
  and pediatric patient with SVT, 420–421
  in procedural sedation
    assessment procedures, 444–445
    emergency equipment, 446, 447
    Mallampati Scale, 445
    preprocedure instructions, 445
    Risk Classification Scale, 446, 446
nursing process, for pediatric patient with
  SVT, 420–421, 421
office visits
  device evaluation in, 336, 337, 338
  importance of, 265
Ohm’s law, 149
OptiVol Fluid index monitoring, 247, 249, 252, 253
orthostatic hypotension (OH)
  classic, 370
defined, 371
delayed, 372
orthostatic intolerance (OI)
  ANS disorders of
    autonomic failure syndromes, 370–372
    reflex syncopés, 368–370
  autonomic disorders associated with, 367
  symptoms of, 373–374
ORT (orthodromic tachycardia)
  circuit of, 60
  left bundle branch block in, 66
outflow tract VT, 131
output failure, 218–219
oversensing
  case study, 223, 227, 281–282
defined, 282
  in device evaluation, 342
differential diagnosis of, 197
electrical interference and, 344
  pacemaker problems with, 218
  T wave, 282, 306, 307, 340
  and undersensing, 196–197
oxygen, during procedural sedation, 448–449
  in children, 406–408
diagnostic information for, 201
  electromagnetical interference, 221–222
  at end of life, 216
  and exercise tests, 225, 226
  heart rate counter/high rate counter, 203–204
  heart rates in, 212–213
    mode switch, 213–214
    MSR/activity sensor, 213–214
    MTR, 212–213
    rate hysteresis, 213–214
    sleep rate/rest rate, 213
  intrinsic rhythms in
    atrial, 207–208
    ventricular, 208–209
  leads in, 200, 206
  mode switch in, 205
  output, 212
  paced and sensed events in, 103, 201
  postoperative considerations, 220–221
  rate response sensor test in, 211
  retrograde conduction test in, 211
  schedule for, 214, 215
  sensitivity in, 212
  sensor rate counter in, 204–205
  symptoms in, 199
  syncope in, 226–230
  testing in, 207
    chest X-ray, 214
    event recording, 214
    Holter monitor, 214
    troubleshooting in, 217–219
  ventricular automatic pacing threshold
    algorithm in, 210–211
  ventricular threshold in, 210, 210
pacemaker behavior, 190–191. See also
  pacemaker modes
cross talk, 191, 192
  intrinsic conduction search, 192–194
  pacemaker-mediated tachycardia, 192
  URB, 191
pacemaker capture, 181. See also capture
  pacemaker check, printout from, 224
pacemaker follow-up, 198–199. See also
  device follow-up; programming, pacemaker
  AT/AF log, 205–206
  atrial automatic pacing threshold algorithm
    in, 211
  atrial threshold in, 209
  AV and ventriculoatrial intervals, 205
  basic information for, 199
  battery in, 200, 206–207, 207
  case studies, 222–230, 223, 224, 226–230
pacemaker-mediated tachycardia (PMT), 192, 193

pacemaker modes
dual-chamber pacing, 188–191, 189
single-chamber pacing, 187–188

pacemakers
in children, 215, 216, 397–401, 398, 399
components of, 144–154, 144–157, 156
extracardiac stimulation to, 220–221
faulty, 327
history of, 141, 142, 161
increasing use of, 453, 465
indications for placement of, 142, 143
long-term complications with pacemaker syndrome, 219, 219
ventricular dysfunction, 219–220
recipients of, 162
settings, 223

pacemaker sensing, 182. See also sensing
pacemaker sensing intervals
blanking period, 186
PVARP, 185
refractory period, 186
TARP, 186

pacemaker syndrome, 219, 219

pacemaker timing, 181
pacemaker features affecting, 195
programming features altering, 198, 198

pacing, ventricular, 182–183, 183
pacing cells, 6, 7
action potential of, 14–17, 16
automaticity of, 9, 16
compared with cardiac cells, 16, 16
pacing circuits, 145
pacing thresholds, drug effects on, 222
PAF, 371–372. See pure autonomic failure
pain, pacemaker pocket, 221

PainFREE I and II clinical trials, 276

palpitations
in device evaluation, 335–336
syncope related to, 365
para-Hisian pacing, 52–54, 54
parasympathetic nervous system (PNS), function of, 368

partners of ICD patients
case studies with, 322
clinical management of, 317–318

past family history (PFH), in evaluation of arrhythmias, 27. See also history, medical

past medical history (PMH), in evaluation of arrhythmias, 27. See also history, medical

PATH-CHF clinical trial, 237

pathway potential, in AVRT ablation therapy, 69

patient activity graph, in device follow-up, 299

patient confidentiality, 461–462

patient education
for AF, 98
in ICD device follow-up, 279, 290
in pacemaker implantation, 220

patient preparation, for implantation procedure, 164–165, 165, 166

patients. See also ICD patients; pediatric patients
in device recalls
database for, 329
notification of, 329–330
response of, 331
RM recommended to, 332
noncompliant, 455

patients’ rights, and withdrawal of device therapies, 456–458

pediatric patients. See also adolescents; children
arrhythmias associated with syncope in, 365
CRT for, 405–406
diagnoses among pacemaker recipients, 399, 399

follow-up care for, 406–408
with HCM, 366
ICDs in
device selection for, 405
implantation techniques for, 404
indications for, 401, 403, 403–404, 404

pacemakers in
device selection, 400
implantation technique, 399–400
indications for, 397–399, 398
programming considerations, 401, 402
pocket site
determination of, 167
in implantation procedure, 167–168
infection of, 174, 289, 289–290
pain related to, 221
polarization, phenomenon of, 149, 149
polyurethane, for PG leads, 147
Post-AMI Heart Failure Efficacy and Survival Study (EPHESUS), 118
Post AV Nodal Ablation Evaluation (PAVE) trial, 239–240
postmortem evaluation, of cardiac implant devices, 349, 349, 350, 351
postural tachycardia syndrome (POTS), 368
definition of, 370
diagnosis of, 371
forms of, 370–371
impairment in physical functioning in, 361
physiology of, 371
postventricular atrial refractory period (PVARP), 185, 257, 257, 401
potassium channel blockers, properties of, 21–22
potassium channels, characteristics of, 9, 11
potassium ions
in cardiac action potential, 13, 13–14, 14, 15
in depolarization of pacing cells, 16
POTS. See postural tachycardia syndrome
pre-excitation
in AVRT, 59
on 12-lead EKG, 64
premature atrial beats, and pediatric SVT ablation, 423
premature ventricular contractions (PVCs), 101
in bigeminal pattern, 102, 105
definition of, 102
unifocal, in nonsustained VT, 102, 105
PREPARE study, 276
preschoolers, follow-up care for, 406, 407. See also pediatric patients
procainamide, 18
in Brugada syndrome, 380, 380
in pediatric SVT, 420
product advisory, 329
<table>
<thead>
<tr>
<th>Programming, pacemaker, 211–212</th>
<th>Programming, review of ICD, 276–277</th>
</tr>
</thead>
<tbody>
<tr>
<td>and age of patient, 215</td>
<td>propafenone, 19–20</td>
</tr>
<tr>
<td>base rate, 212</td>
<td>action of, 20</td>
</tr>
<tr>
<td>for complex congenital heart defects, 216</td>
<td>in AVNRT, 56</td>
</tr>
<tr>
<td>for intercurrent disease, 215–216</td>
<td>effect on pacing threshold of, 222</td>
</tr>
<tr>
<td>P wave</td>
<td>propranolol</td>
</tr>
<tr>
<td>in atrial tachycardia, 73</td>
<td>effect on pacing threshold of, 222</td>
</tr>
<tr>
<td>in AVNRT, 77</td>
<td>for pediatric patient with SVT, 421</td>
</tr>
<tr>
<td>Pseudofusion beat. in pacemaker capture, 182, 182</td>
<td>psychological assessment, of ICD patients, 319</td>
</tr>
<tr>
<td>Psychological assessment, of ICD patients, 319</td>
<td>psychological adjustment, of pediatric patients, 406–407</td>
</tr>
<tr>
<td>Psychosocial issues, for ICD patients, 312–315</td>
<td>PTSD (posttraumatic stress disorder), in ICD patients, 313</td>
</tr>
<tr>
<td>Pseudofusion syndrome (PS), for ICD patients, 97</td>
<td>PV antral isolation (PVI), 90, 98</td>
</tr>
<tr>
<td>Patient selection for, 90</td>
<td>patient contact in, 330–331</td>
</tr>
<tr>
<td>Periprocedural anticoagulation for, 92</td>
<td>and postnotification visit, 332</td>
</tr>
<tr>
<td>Postprocedural care and follow-up for, 95</td>
<td>readiness for, 328–329</td>
</tr>
<tr>
<td>Potential complications during, 94, 94</td>
<td>review of, 332</td>
</tr>
<tr>
<td>Preprocedure care and preparation for, 90–92, 91</td>
<td>role of AP in, 327, 328, 333</td>
</tr>
<tr>
<td>Successful, 95</td>
<td>Reconditioning program, for patients with syncope, 378</td>
</tr>
<tr>
<td>P wave</td>
<td>Reentrant tachycardia, 8, 8</td>
</tr>
<tr>
<td>in atrial tachycardia, 73</td>
<td>Reflex syncopes, 368–370</td>
</tr>
<tr>
<td>in AVNRT, 77</td>
<td>Refractory period, 186</td>
</tr>
<tr>
<td>QRS complex, 102, 103</td>
<td>Remote monitoring (RM). See also telephone pacemaker check</td>
</tr>
<tr>
<td>QT interval, 102</td>
<td>Quality of life (QOL)</td>
</tr>
<tr>
<td></td>
<td>for ICD patients, 314–315, 319–321</td>
</tr>
<tr>
<td></td>
<td>outcomes, 311</td>
</tr>
<tr>
<td>Quinidine</td>
<td>Quinlan case, 456</td>
</tr>
<tr>
<td>in Brugada syndrome, 136</td>
<td>Radiation therapy, device evaluation and, 344, 346</td>
</tr>
<tr>
<td>Effect on conduction of, 18</td>
<td>Radiofrequency ablation</td>
</tr>
<tr>
<td></td>
<td>of accessory pathways, 67–71</td>
</tr>
<tr>
<td></td>
<td>for atrial flutter, 96</td>
</tr>
<tr>
<td></td>
<td>in atrial tachycardia, 75</td>
</tr>
<tr>
<td></td>
<td>for AVNRT, 56–59, 57, 58</td>
</tr>
<tr>
<td></td>
<td>for pediatric patients, 420</td>
</tr>
<tr>
<td></td>
<td>in VT, 130</td>
</tr>
<tr>
<td>Back to index</td>
<td>Rapid eye movement-associated behavior disorder (RBD), 371</td>
</tr>
<tr>
<td>Back to index</td>
<td>Random access memory (RAM), in ICD circuitry, 154</td>
</tr>
<tr>
<td>Back to index</td>
<td>Recalls, 459</td>
</tr>
<tr>
<td>Back to index</td>
<td>Decision making in, 330</td>
</tr>
<tr>
<td>Back to index</td>
<td>Definition of, 327–328</td>
</tr>
<tr>
<td>Back to index</td>
<td>Notification of, 329–331</td>
</tr>
<tr>
<td>Back to index</td>
<td>and notification of patients, 329, 330</td>
</tr>
<tr>
<td>Back to index</td>
<td>Patient contact in, 330–331</td>
</tr>
<tr>
<td>Back to index</td>
<td>and postnotification visit, 332</td>
</tr>
<tr>
<td>Back to index</td>
<td>Readiness for, 328–329</td>
</tr>
<tr>
<td>Back to index</td>
<td>Review of, 332</td>
</tr>
<tr>
<td>Back to index</td>
<td>Role of AP in, 327, 328, 333</td>
</tr>
</tbody>
</table>

**Rationale for Indexing:**

- **Programming, Pacemaker:** This section includes terms related to programming of pacemakers, such as base rate, age of patient, and review of ICD, which are crucial for understanding the operational aspects of pacemakers.
- **Propafenone:** The section on propafenone discusses its action in AVNRT and its effect on pacing threshold, indicating its importance in arrhythmia management.
- **Pseudofusion Beat:** This term is linked to pacemaker capture, which is essential for understanding pacemaker functionality.
- **Psychological Assessment:** This term is significant for ICD patients, highlighting the emotional and psychological impact of implantation.
- **Psychosocial Adjustment:** The section on psychosocial adjustment for pediatric patients is critical for understanding the long-term implications on quality of life.
- **PTSD (Posttraumatic Stress Disorder):** This term is relevant for ICD patients, emphasizing the psychological impact of implantation.
- **PTSS (Posttraumatic Stress Syndrome):** This term is linked to pediatric cancer patient survivors, highlighting the broader psychological impact.
- **Pulse Generator:** The detailed section on the pulse generator (PG) components and principles is important for understanding its design and functionality.
- **Pulse Oximetry:** The mention of pulse oximetry during procedural sedation is relevant for monitoring patients during interventions.
- **Pure Autonomic Failure:** This term is linked to pediatric cancer patient survivors, indicating the complex spectrum of conditions.
- **Purkinje Fibers:** These fibers are discussed in relation to arrhythmias, highlighting their role in cardiac conduction.
- **PV Antral Isolation:** This procedure and its potential complications are detailed, which is crucial for understanding catheter ablation techniques.
- **Quality of Life:** This term is linked to ICD patients, emphasizing the importance of patient-reported outcomes.
- **Quinidine:** The section on quinidine effect on conduction is significant for understanding its role in cardiac rhythm management.
- **Radiation Therapy:** This term is linked to device evaluation and consideration, indicating the importance of radiation exposure.
- **Radiofrequency Ablation:** This technique is discussed in relation to accessory pathways, atrial flutter, atrial tachycardia, AVNRT, and pediatric patients, highlighting its clinical relevance.
- **Ramsay Scale:** The modified Ramsay scale is mentioned, indicating its use in assessing sedation levels.
- **Random Access Memory (RAM):** This term is linked to ICD circuitry, indicating the technological aspects.
- **Rapid Eye Movement-Associated Behavior Disorder (RBD):** This term is significant for its association with syncope.
- **Recalls:** This section on recall decision making and notification is crucial for ensuring patient safety and care.

**Conclusion:** The index provides a comprehensive overview of key terms and concepts related to pacemakers, arrhythmias, and patient care, highlighting their importance in clinical practice and research.
remote monitoring (continued)
for ICDs, 265, 277, 277–278, 278
impact of, 295
scheduling site for, 295, 296
types of, 294, 294
web site for, 295, 297
replacement, device, patient demand for, 460.
See also recalls
repolarization, in cardiac action potential, 9,
13, 13–14, 15
rescue pacing, 7, 15
resistance training, for patients with syncope, 378
rest rate
in pacemaker follow-up, 213
pacemaker interval timer for, 184
restrictive cardiomyopathy (RCM), 110,
112–113
resynchronization devices. See also cardiac
resynchronization therapy
case study, 176
implantation of, 171–172
retrograde conduction, electrophysiology
diagnosis of, 51–55, 54
rhythm disorders, 25
right ventricular outflow tract (RVOT)
ventricular tachycardia, 127
case study, 136, 136–137
electroanatomical mapping of, 136
mapping and ablation for, 435
morphology of, 131, 132
treatment options for, 131
risk behaviors, psychosocial, 318
SAECG. See signal-averaged ECG
safety alerts, 329, 459. See also recalls
St. Jude Medical ACAP Confirm, 211
Salgo v. Stanford University, 455
SA node
anatomy of, 6, 6
blood supply for, 6–7
physiology of, 6
sarcoidosis, restrictive cardiomyopathy caused
by, 112
“sawtooth” pattern, for atrial flutter, 96, 96, 97
“scar” maps, 433, 434
SCD-HeFT clinical trial, 119, 241, 242
school-age children. See also pediatric patients
follow-up care for, 406
SVT in, 412
SCN5A gene, 134–135
sedation. See also anesthesia
for implantation procedure, 165–166
moderate, 451
procedural
defined, 443
documentation of, 450
medications for, 444
nursing care in, 444–446, 445
patient monitoring during, 446–449, 449
postprocedural care, 449–450
potential complications during, 450–451
risk of, 173
selective serotonin reuptake inhibitors (SSRIs),
in NCS, 379
Senning procedure, 401
sensing
defined, 182
on EGM, 182–183, 183
problems with, 197
sensing integrity counter (SIC), in ICD
diagnostics, 272–273, 274
sensing problems, on pacemaker ECG,
195–197, 196
sensing thresholds, in device follow-up,
305–306
septal pathways
in AVRT ablation therapy, 71
nomenclature for, 61
shock anxiety
assessment of, 319
in ICD patients, 312–313, 316
shock impedance, testing, 305
shocks
on ECG, 337
repeated inappropriate ICD, 289
short QT syndrome (SQTS), SCD related to,
389
SIC. See sensing integrity counter
signal-averaged ECG (SAECG), 30–32, 34
abnormal, 34
in cardiomyopathy, 117
silicone, for PG leads, 147

double-chamber pacing
  asynchronous mode, 187
  demand mode, 187
  rate-responsive mode, 188
  triggered mode, 187–188

sinoatrial node. See SA node

sinus node dysfunction, in pediatric patients, 398

situational syncope, 368

sleep rate
  in pacemaker follow-up, 213
  pacemaker interval timer for, 184

slow pathway, ablation of, 57–58, 58

social history, in evaluation of arrhythmias, 27. See also history, medical

social support, for ICD patients, 315, 316, 317

sodium/calcium exchange (NCX), 9, 10

sodium channel blockers, 17–20, 18, 19

sodium channels, characteristics of, 9, 11

sodium ions
  in cardiac action potential, 13, 13–14, 15
  in depolarization of pacing cells, 16

sodium/potassium pump, 9, 10

sotalol, 21, 22, 421

spouses, of ICD patients, 315, 317, 317

stress testing, in syncope evaluation, 376. See also exercise stress testing

Sudden Arrhythmic Death Syndrome Foundation, 407

Sudden Cardiac Death in Heart Failure Trial (SCD-HeFT), 390, 391

sudden cardiac death (SCD)
  in athletes, 364
  defined, 387
  etiologies of, 387–388, 388
    CAD, 387–388, 388
    cardiomyopathy, 388, 388–389
    primary electrophysiological disorders, 389
    HF associated with, 240, 241–242, 242
    hypertrophic cardiomyopathy in, 112
    ICD clinical trials and, 241–242
    identification of patients at risk for, 391–392
    impact of ICD therapy on, 389–390, 390

incidence and mortality associated with, 387, 388

literature review, 390, 390–391

mechanisms of, 389, 389

prophylaxis for, 161

risk of, 128

risk stratification for, 391–392

syncope associated with, 364

therapeutic considerations, 392

trials of ICDs related to, 390, 390

from VT syndromes, 127, 136

sudden infant death syndrome (SIDS), 373

suicidal ideation, assessment of, 319

suicide, assisted, 456–457

supraventricular arrhythmias, common drugs for, 17, 20

supraventricular tachycardia (SVT)
  algorithm for, 75, 76
  causes of, 42
  in children, 411
  clinical presentation of, 42
  common forms of, 41–42
  defined, 41–42, 411
  inappropriate therapy for, 287, 288
  incidence of, 41
  in pediatric patients, 365
    ablation therapy for, 420–422, 422, 423
    AP-mediated tachycardias, 413, 415, 416,
      416–417, 417
    case studies, 424, 424–426
    complications of, 422, 423, 424
    diagnosis of, 413, 414
    differential diagnosis for, 412–413
    etiology of, 412
    history in, 412
    incidence/prevalence of, 411–412
    preventive management of, 419
    prognosis for, 422
    signs and symptoms in, 412
    treatment for, 419–422, 421, 422, 423
    types of, 415

surgical electrocautery, 341, 344, 345

SVT. See supraventricular tachycardia

sympathetic nervous system (SNS), 368

symptoms, in device evaluation, 335

syncopal episode, characteristics of, 373
syncope, 379–380, 380
and ANS disorders of OI, 368–372
arrhythmogenic causes of, 364–365
and blood pressure control, 367–368
cardiovascular causes of, 362, 364, 379
dysrhythmias, 364–365, 365
nonarrhythmic, 365–366
case studies, 379–380, 380
causes of, 362, 362, 363
classification of, 361–364, 362, 363
conditions precipitating, 369
defined, 359
in device evaluation, 336
diagnostic evaluation of
H&P examination, 372, 372–375, 374, 375
testing, 375–378
economics of, 360
epidemiology of, 360–361
evaluation of, 365
exertional, 366
ICR of patient with, 33
incidence of, 359
neurally mediated, 369
noncardiac causes of, 362, 366–367, 367
in pacemaker follow-up, 226–230, 227–230
presyncope, 372
reflex, 368–370
secondary cause for, 378
treatment for
conservative approach, 378
pharmacotherapy, 378–379
unexplained, 378
of unknown cause, 362, 364
systolic dysfunction, 232
tachyarrhythmias, syncope related to, 364–365
tachy-brady syndrome, as complication of
implantation procedure, 175
tachycardia. See also atrial tachycardia;
ventricular tachycardia
balanced endless loop, 255
dynamic maneuvers to diagnosis
mechanism of, 50–51, 52, 53
pacemaker-mediated, 192, 193
pathway-to-pathway, 61
pre-excited, 61
reentrant, 8, 8
tamponade, PVI associated with, 94
Tawara, node of, 8
team, implant, 161, 162, 162
team approach, to atrial fibrillation, 98
telephone pacemaker check, 293–294, 294
TENS (transcutaneous electrical nerve stimulation), in device evaluation,
246–247
testing
in device follow-up, 304–308, 307, 308 (See also threshold testing)
in pacemaker follow-up, 207, 214
tetralogy of Fallot (TOF)
and ICD therapy, 403
repaired, 113
Thorel’s pathway, 7
threshold margin test, for telephone
pacemaker check, 294
thresholds, drug effects on, 222
threshold testing. See also capture threshold
testing
loss of atrial capture during, 209, 209
loss of ventricular capture during, 210, 210
in pacemaker check, 209, 209–211, 210
in pacemaker follow-up, 207
timing cycle, defined, 181
Timothy syndrome, 404
titanium, in pulse generator manufacture,
144–145
tocainide, 19
Todaro, tendon of, 43, 44, 49
toddlers. See also pediatric patients
ablation therapy for, 420
follow-up evaluation for, 407
SVT in, 412
torsades de pointes (TdP), 104, 133, 133
defined, 102
electrocardiographic features in, 102, 106
total atrial refractory period (TARP), 186, 186
transcutaneous electrical nerve stimulation (TENS), in device evaluation, 246–247
transesophageal echocardiogram (TEE), 35
transesophageal pacing, in pediatric SVT, 424
transformers, in implantable cardiac devices,
153, 154
transporters, 9, 10
traumatic brain injury, falls and, 360
treated VT/ventricular fibrillation (VF) episodes, 267, 269, 269
tricuspid annulus, ablation on, 70–71
triggered activity
  in idiopathic VT, 129, 129
types of, 108, 108
T wave alterans (TWA). in cardiomyopathy, 117
twiddler’s syndrome, 220, 284, 285, 408
Type D Personality Scale (DS14), 316
ultrasound, high-intensity focused, 440, 441
undersensing
  differential diagnosis of, 196
  oversensing and, 196–197
  on pacemaker ECG, 198
  pacemaker problems with, 218
upper limit of vulnerability (ULV), in DFT, 171
URB
  on ECG of exercise test, 225, 226
  pacing rate during, 191
vagal maneuvers
  for AVNRT, 55
  for pediatric SVT, 419
vagotonic maneuvers, for AVRT, 67
valsalva maneuver, for AVNRT, 55
vancomycin, during implantation procedure, 167
Vaughan Williams classification, 17
venous pathways, in AVRT ablation therapy, 71
ventricular arrhythmias
  classification of, 102, 103–104
  clinical presentation of, 103
  electrocardiography in, 103–104
  ventricular assist devices (VADs), in device evaluation, 348–349
  ventricular automatic pacing threshold, 210–211
  ventricular-based timing, of dual-chamber pacemakers, 188
  ventricular capture, QRS morphology with loss of, 244, 245
ventricular decoupling, defined, 234
ventricular dysfunction, with long-term pacemaker use, 219–220
ventricular fibrillation (VF), 101, 104, 343
  false detection of, 340
  ICD therapy for, 141–142
  and syncope, 364
ventricular flutter
  classification of, 104
  on postmortem interrogation, 350
ventricular pacing, inhibition of, in device evaluation, 342
ventricular pacing threshold, on ECG, 341
ventricular rhythm, erratic, on ECG tracing, 339
ventricular rhythm, intrinsic, in pacemaker follow-up, 208–209
ventricular sense response (VSR), 244, 245
ventricular tachycardia (VT), 101
  bidirectional, 104
  cardiomyopathy associated with, 121
  ablation for, 120, 120–121
  ICD for, 119–120, 121
  medical management of, 117–119, 119
  causes of, 109
  defined, 102
  in device follow-up, 302
  etiology of, 102
  event monitor recording of, 31
  ICD therapy for, 141–142
  idiopathic, 128
  mapping of, 435–436
  mechanisms of, 107, 107–108
  abnormal impulse conduction, 109, 109, 110
  abnormal impulse formation, 108, 108
  myopathy associated with
    case studies, 121–122
    with underlying CAD, 122
  nonsustained (NSVT), 102, 286
  polymorphic, 102
  on postmortem interrogation, 349, 349
  in structurally normal heart, 136, 136–137
    Brugada syndrome, 134–136, 135
  causes of, 127, 128
  classification of, 127, 128
  clinical presentation, 127
ventricular tachycardia (continued)
diagnosis of, 127–128, 128
electrophysiology study and catheter ablation of, 130–131
ILVT, 131–133
incidence of, 136
LQTS, 133, 133–134
outflow tract VTILVT, 131, 132
sustained monomorphic, 102, 105
and syncope, 364
ventricular tachycardia (VT) circuit, potential, 110
ventricular threshold, in pacemaker follow-up, 210, 210
ventriculoatrial (VA) conduction, 48, 52, 53
ventriculoatrial (VA) time, in para-Hisian pacing, 54
verapamil
antiarrhythmic properties of, 22
in AVNRT, 56
effect on pacing threshold of, 222
warfarin, for AF, 87–88, 88
wave sensing, far-field R, 183, 183
Wenckebach phenomenon, 225–226, 226
Wenckebach’s tract, 7
Wenckebach window, 191
wireless technology, 407
wireless telemetry, remote monitoring and, 294–295
Wolff-Parkinson-White (WPW) syndrome, 61, 62, 63
ablation for, 431
incidence of, 412
in pediatric patients, 365, 416, 416
SCD related to, 389
World Health Organization (WHO), 110, 387
wound assessment, after implantation procedure, 173
X-ray, after implantation procedure, 172, 174.
See also chest X-ray