Index

Page numbers in italics refer to illustrations; those in bold refer to tables

ABC score 33
ABO-incompatible heart transplantation 640
absent PV syndrome 525
Academia Council for Graduate Medical Education (ACGME) 17–20, 27
adrenergic receptors (ARs) 91–93
adrenergic receptor signaling
developmental changes 93–94
in acute myocardial dysfunction 101–102
in congenital heart disease 102–103
in congestive heart failure and cardiomyopathy 103
adapted cardiomyopathy 104
adult congenital heart disease (ACHD) patients 354–355
cardiac lesions 362–371
atrial septal defects 363–364
coarctation of the aorta 365–366
congenitally corrected transposition of the great arteries 368

dextro-transposition of the great arteries 368–370
Eisenmenger's anomaly 359, 366–367, 366
partial anomalous pulmonary venous connection 364
patent ductus arteriosus 365
patent foramen ovale 363
pulmonary valve stenosis 366
single-ventricle anatomy 369–370
tetralogy of Fallot 367–368
ventricular septal defect 365
Down syndrome and 361–362
hematological sequelae 357
hepatic sequelae 358
neurological sequelae 357–358
non-cardiac surgery issues 372–373
pregnancy issues 359–361
psychological sequelae 362
pulmonary sequelae 355–356
exercise capacity 355
static lung function 355
renal sequelae 357
transplant and 371–372
unrestricted shunts 359
vascular access considerations 358–359

acute fulminant myocarditis 740
acute kidney injury (AKI) 143–144, 173–175
acute normovolemic hemodilution (ANH) 310
acute stress response 177
adrenergic receptor signaling
developmental changes 93–94
in acute myocardial dysfunction 101–102
in congenital heart disease 102–103
in congestive heart failure and cardiomyopathy 103
adrenal insufficiency 735–736
adenoma sebaceum 623
adhesion molecules 161
adrenaline 428–429
side-effects 429
supraventricular tachycardia management 416, 418, 419
endotracheal tube selection 436–437
extubation 441

afibertanil 866
alpha-1 receptor 442
hemodynamic effects 442–443
intra-aortic balloon pump 444
intubation 437–438
myocardial ischemia 442
pneumonia 443
procedural sedation 444
pulmonary hypertension surgery 674–675
weaning from ventilation 731–732
see also ventilation

airway pressure release ventilation (APRV) 447
alfentanil 415–416
alpha-1 receptor 442
hemodynamic effects 442–443
intra-aortic balloon pump 444
intubation 437–438
myocardial ischemia 442
pneumonia 443
procedural sedation 444
pulmonary hypertension surgery 674–675
weaning from ventilation 731–732
see also ventilation

amiodarone 415–416
amino acidemia, dilutional 234, 309, 310
amino acids 384
analgesia see pain management
anemia, dilutional 234, 309, 310
anesthesia
cardiac catherization 680–681, 684–686, 687
electrophysiology procedures 700–703
fast-tracked patients 455–456
low-flow anesthesia 196–197
outcomes 29–31
outcome transparency 30
predictive outcomes analysis 33
see also anesthesia-induced neurotoxicity
preconditioning 192, 195–196
ventilators 449
see also anesthetists; specific conditions
anesthesia-induced neurotoxicity 184–191
cell age-specific vulnerability 189
mechanisms 186–189
brain-derived neurotrophic factor 188–189
extrinsic apoptosis pathway 187–188
intrinsic apoptosis pathway 187, 188
oxidative stress 187
neurodevelopmental outcome
studies 189–191
preclinical studies 184–186
see also neuroprotection
Anesthesiology Milestone Project 25
anesthesiology training see education
anesthetic agents 120
benzodiazepines 110–111
cardiac catherization 685–686
conditions affecting pharmacokinetics and pharmacodynamics 119–122
cardiodiarympathic bypass effects 119–121
hypothermia effects 121
interradical shunt effects 119
conduction system effects 702
tachycardia and 702–703
dexametomidine 116–119, 118
etomidate 115–116
hemodynamic effects 673–674, 673
ketamine 113–114, 115
nitrous oxide (N_2O) 110

Andropoulos bindex.tex V1 - 06/15/2015 9:55 A.M. Page 782
low cardiac output syndrome (LCOS) 377, 379
mechanical circulatory support
indication 752
see also hemodynamic management
low-flow anesthesia 196–197
lung function see pulmonary physiology
lung injury 169
prevention 142–143
transfusion-related acute lung injury (TRALI) 172
infection prophylaxis 771
resuscitation of cardiac arrest 753
sepsis, 753–754
see also extracorporeal membrane oxygenation (ECMO); ventricular assist devices (VAD)
mechanical ventilatory support
mediastinal drains 559
mediastinal masses 630–635
anatomy 630–632
anesthesia 633–635
diagnosis 631–632
incident 631
pathophysiology 632
nepaticoventricular dyssynchrony 635
medication related 635–638
post-transplant proliferative disorder 320
non-cardiac surgery 707
metabolism, receptor signaling 101–102
membrane oxygenator 130
mepiprinide premedication, effect 193
membrane oxygenator 130
mesenteric ischemia 176–177
mesocardia 47, 48, 72–73
mesophosis 73–74
methylene blue 139
metoprolol 427
mexiletine 425
midazolam 110, 111, 685
hemodynamic effects 673
preconditioning 195
medication 331
see also fentanyl/midazolam
milestones for anesthesiology training 25
milrinone 384, 392, 672
Milwaukee cohort 247
motifional permeability transition pore (MTPP) 103–104
mitral atresia with VSD 582–583
mitral regurgitation 618–622
anesthetic considerations 620–622
mechanisms 618–620
pathophysiology 620
residual 733
surgical approaches 620, 621
mitral stenosis 584
anesthetic considerations 514
pathophysiology 513
surgical approaches 513–514
mitral valve 77
anterior leaflet cleft 54
congenital mitral regurgitation 54
functional anatomy 618, 619
see also mitral regurgitation, mitral stenosis;
Shone’s complex
mixed venous saturation 398–399, 399
MMF (CellCept) 644
Model for End-stage Liver Disease (MELD) 358, 648
modified ultrafiltration (MUF) 138–139, 138
arterial switch operation 247
bidirectional cavopulmonary anastomosis 588
hypoplastic left heart syndrome surgery 575
inflammatory response reduction 138–139,
163, pulmonary benefits 172–173
transfusion management 166
see also ultrafiltration
morphine
historical background 2, 4, 6
neurotoxicity 185
postoperative pain management 462, 464, 465
premedication 2, 110
multidisciplinary approach 315
non-cardiac surgery 706
multisystem organ failure (MSOF) 156–157,
177
Mustard operation 9, 267
transposition of the great arteries 368–369,
378, 352, 553, 554
congenitally corrected TGA 563–564
Mycoplasma pneumoniae infection, cold
agglutinin disease and 150–151
myocardial performance index (MPI) 267
myocardial preconditioning 103–104
myocardial protection, cardiopulmonary bypass 135–136
myocarditis 754
myocardium
acute fulminant myocarditis 740
contractility 86
decreased 735–736
deforination assessment 267
development 44–45
differentiation 60
dysfunction, receptor signaling 101–102
diabetes 341, 734
fetal 86
ischemia 733–734
long-term sequelae of congenital heart disease 90–91
neonatal 86
ischémia tolerance 135
nutrient delivery 58
terries of major coronary arteries 266
myocyte structure 95
myosin 623, 624
near-infrared spectroscopy (NIRS) 177
arterial switch operation 556
cerebral oxygenation monitoring 239–242,
241
global oxygen saturation monitoring 397–398
near misses 30
nerotizing enterocolitis (NEC) 176–177, 347
neo-aortic valve 560, 569
neutrophils
caloric requirement 340
early complete repair 338–339
early palliation 336–338
functional residual capacity (FRC) 340
inflammatory response to cardiopulmonary bypass 340–341
limited physiologic reserve 339–340
lung transplantation 651
neurologiai injury 342
outcomes 339
preoperative assessment 320
stress response 343–344
see also low-birth-weight neonates (LBWNs);
preadterm infants
neostigmine 123
inesitide 301
neuroblastomas 631
neurofibromas 631
neurological complications 13, 142, 230–231
arterial switch operation 560
congenital heart disease sequelae 357–358
deep hypothermic circulatory arrest (DHCA) 6, 145–146, 146
eextracorporeal membrane oxygenation (ECMO) 465
intensive care unit 743–745
long-term outcomes 242–246, 247
Boston Circulatory Arrest Study 242–244
Children’s Hospital of Philadelphia cohort 244
Hearts and Minds Study 245

Index
### Index 793

**pulmonary veins** 75
  - atretic 65
deviation 63–65, 64
  - abnormalities 64–65
  - hypoplastic 65
  - stenosis 65
**pulmonary venous drainage** 75
  - obstruction 656
  - pulsatile Glenn shunt 585
  - pulse contour analysis of the arterial waveform (PiCCO) 223
**pulsed-wave Doppler** 268
  - pulso paradoxus 616
  - pumps, cardiopulmonary bypass 129–130
**Purkinje fibers** 59
  - quality of life issues 560
  - extracorporeal membrane oxygenation 774
  - heart transplantation 647
  - quinidine 425
**RACHS-1 scoring system** 33
  - radial artery access 207, 208
  - arterial cutoff 210
  - radiofrequency ablation 699–700
  - hemodynamic effects 673
  - fast-tracked patients 456
**Rastelli operation** 287, 288
  - postoperative concerns 552
  - transposition of the great arteries 369–370, 551, 552, 553
  - congenitally corrected TGA 563–564
  - reactive oxygen species (ROS) 187
  - receptor signaling 2 adrenergic receptor signaling
  - recombinant factor VIII, postoperative bleeding management 305
  - red blood cells (RBCs) 71
  - cell salvage 311–312
  - transfusion 304
  - re-entry tachycardia 697, 700
  - anesthetic drug effects 702
  - regional cerebral perfusion 703 selective cerebral perfusion
  - reimplantation technique, aortic root 629
  - reperfusion injury 137, 540
  - renin 100
  - renal replacement therapy 143–144, 173–176
  - continuous veno-venous hemofiltration (CVVH) 176
  - dialysis 143–144, 173–176, 559, 747
  - extracorporeal membrane oxygenation 774
  - patients 741
  - intensive care unit 747
  - nitric oxide 703
  - reoxygenation injury 135
  - reperfusion injury 137, 540
  - amputations 172
  - respiratory complications 2 historical background 3 transesophageal echocardiography 284–287
  - right ventricle 76
  - right atrium 75
  - right-to-left intracardiac shunt 516
  - effect on anesthetic metabolism 119
  - right ventricle 76
  - intrathoracic pressure effect 393, 727–728
  - myocardial performance index (RVMP) 267
  - postoperative dysfunction 530, 540
  - systolic function assessment 276
  - right ventricle-to-pulmonary (RV–PA) shunt 570–572
  - right ventricular outflow tract (RVOT) hyperdynamic, postoperative 531
  - obstruction 276–281
  - adult patients 366
  - Ebstein’s anomaly 519
  - intensive care considerations 725
tetralogy of Fallot
tetra-remodeling technique, aortic root 629
  - postoperative shunt fraction calculation 267
  - right atrioventricular isomerism 74
  - Riley–Day syndrome 69
  - Risk Adjustment for Congenital Heart Surgery (RACHS-1) scoring system 33
  - surgery 332–333, 333
  - low-birth-weight neonates 349
  - risk stratification 332–334, 334
  - neomycin 123
  - rollerpumps 129
  - Romano–Ward syndrome 422
  - Ross Heart Classification Scale 318, 319
  - Ross procedure 499, 499
  - Ross–Konno procedure 499, 512
  - Rotaflow® centrifugal pump 756, 757, 758, 759
  - Royal Children’s Hospital, Melbourne, Australia, anesthesia-related mortality data 37
  - saccular aneurysms 626
  - saphenous vein access 217
  - sarcoplasmic reticulum (SR) 94–96
  - scar flatter 416
  - saccular syndrome 364
  - isoprenaline premedication 110
  - historical background 2, 3
  - sedation 559
  - cardiac catheterization 685–686
  - mechanical circulatory support 767–768
  - weaning from ventilation 731
  - sevoflurane 731
  - myocardial performance index (RV): 551–552, 552
  - Simpson’s method of discs (MOD) 265
  - single-lung ventilation (SLV) 442–443
  - balloon-tipped bronchial blockers 442–443
  - double-lumen tubes 443
  - single-lumen ETT 443
  - Univent® tube 443
  - single pulmonary vein 65
  - single ventricle malformations 52, 60, 288–292, 883, 722
  - adult patients 369–370
  - circulatory support issues 739–740
  - heart transplantation 596
  - non-cardiac surgery and anesthesia 596, 712
  - management strategies 711, 711
  - shunt-dependent patients 712
  - with AV valve regurgitation 712
  - palliation 292
  - pathophysiology 570
  - transesophageal echocardiography 289–292, 290
  - with heterotaxy syndrome 583–584, 584
  - see also hypoplastic left heart syndrome (HLHS)
  - Single Ventricle Reconstruction (SVR)
  - Trial 245–246, 570–572
  - sinoatrial node (SAN) 59
  - sinus bradycardia 404–405
  - sinus node dysfunction 405
  - sinus of Valsalva aneurysm 627–628
  - sinus tachycardia 407
  - sinus venous defect 49–51, 65, 271, 274, 475
  - adult patients 363
  - see also atrial septal defects (ASD)
  - sirolimus 644
  - situs ambiguous 73, 74
  - atrial 74
  - sinus inversus 47, 74
  - atrial 74
  - visceral 73
  - situs solitus 74
  - atrial 73
  - visceral 73
  - six Cs 31
  - slide tracheoplasty 607–608, 607
  - small airway edema 169
  - Society of Cardiovascular Anesthesiologists (SCA) Adult Cardiac Anesthesia Database 32
  - Society of Pediatric Anesthesia (SPA) 27
  - Society of Thoracic Surgeons (STS) Congenital Heart Surgery Database (STS-CHSD) 32, 38, 39–40

  - indication for mechanical circulatory support 753–754
  - prophylaxis 559–560
  - serine protease inhibitors 163
  - serotonin release assay 300
  - sevoﬂurane 13, 106–107, 109, 108, 109, 665
  - hemodynamic effects 673
  - neurotoxicity 187
  - mechanisms 187
  - Shone’s complex 279, 512–513
  - anesthetic considerations 513
  - pathophysiology 512
  - surgical approaches 512–513
  - shortening fraction (SF), left ventricle 264
  - shunts 723
closure 690, 694
  - decreased pulmonary blood flow 724–725
  - increased pulmonary blood flow 723–724
  - clinical consequences 723–724
  - complex shunt 723
  - simple shunt 723, 723
  - intensive care considerations 723–725
  - shunt fraction outflow tract (RVOT) 725
  - target systemic oxygen saturation level 725
  - sick euthyroid syndrome 181
  - sickle cell disease 331–332
  - cardiopulmonary bypass and 149–150, 150
  - sildenafil 171, 388–389, 669
  - Simpson’s method of discs (MOD) 265
  - simulation in medical education 22
  - single lung ventilation (SLV) 442–443
  - double-lumen tubes 443
  - single-lumen ETT 432
  - Univent® tube 443
  - singe pulmonary vein 65
  - singe ventricle malformations 52, 60, 288–292, 883, 722
  - adult patients 369–370
  - circulatory support issues 739–740
  - heart transplantation 596
  - non-cardiac surgery and anesthesia 596, 712
  - management strategies 711, 711
  - shunt-dependent patients 712
  - with AV valve regurgitation 712
  - palliation 292
  - pathophysiology 570
  - transesophageal echocardiography
  - single-lumen ETT 235–238
  - situs ambiguous 583–584, 584
  - see also hypoplastic left heart syndrome (HLHS)
vascular rings 61, 598–608
anatomy 598–599
diagnosis 599
double and right aortic arches 599–602
anatomy 599
anesthesia 601–602
pulmonary hypertension 599–600
surgery 601, 601, 602
incidence 598, 599
innominate artery compression of the trachea 603–605, 604
anesthesia 604–605
pulmonary artery sling with tracheal stenosis 605–608, 605
anesthesia 608
pulmonary hypertension 605
surgery 604
vascular sling 63
vascular tone regulation 97–100
pulmonary circulation 98, 99
systemic circulation 98–100
vasoactive drugs 380
vasoconstriction 100
vasodilators 386
vasodilatation 97, 100
inhaled nitric oxide (iNO) effect 139
vasodilators
extracorporeal membrane oxygenation
patients 740
pulmonary 367–369, 387
systemic 386–387
tissue 110–111, 123
velocardiofacial syndrome 438
venipuncture 200
venous access 200–206
adult patients 358–359
central venous access 200–204, 201
brachiocephalic vein 216
correct placement ascertainment 205–206
elemental ulcer 203–204, 217
femoral vein 204, 217
internal jugular vein (IJV) 202–203, 212–214, 215, 216
percutaneous access 201–202
peripherally inserted central catheters (PICCs) 206–210
saphenous vein 217
subclavian vein 203, 214
ultrasound-guided 211–217
umbilical vein 204
peripheral venous access 200, 201
ultrasound-guided 211
tunneled silicone catheters 205
see also vascular access
venous system development 65–68, 66, 67
abnormalities 67–68
see also specific veins
ventilation 392
alternative modes of 728–730
anesthesia ventilators 449
during surgery 443–444
cardiopulmonary bypass 448
high-frequency oscillatory ventilation (HFOV) 728–729
hypoplastic left heart syndrome 574
intensive care setting 726–732
lung injury prevention 143
lung transplant patients 654
monitoring 448–449
non-invasive ventilation (NIV) 729
pulmonary hypertension 675
single-lung ventilation 442–443, 444
ventilation/perfusion in lateral decubitus position 441–442
volume control vs. pressure control 448
weaning from 730–731
airway issues 731–732
analgesia and sedation 731

Index 795
ventilation (continued)
fluid balance management 730–731
mechanical circulatory support indications 752–753
nutrition and 731
restrictive defect effects 730
sepsis effect 731
see also airway management; positive end-expiratory pressure (PEEP); positive pressure ventilation (PPV)
ventricles 76–77, 76
see also left ventricle; right ventricle
ventricular arrhythmias 420
premature ventricular contractions (PVCs) 420
ventricular fibrillation 420–425
see also ventricular tachycardia
ventricular assist devices (VAD) 12–13, 709, 758
antibiotic prophylaxis 771
anticoagulation 770–771
conditions affecting 766
devices 758–763, 759
Berlin Heart (EXCOR) 12, 710, 710, 710, 761–762, 761
HeartMate II 762, 762
Impella 759–761, 761
SynCardia Total Artificial Heart (STAH) 762–763, 763
Tandem Heart 759, 760
echocardiography role 764, 765, 767–769
historical background 751
intensive care unit 741–742
non-cardiac surgery and 709–710
outcomes vs. extracorporeal membrane oxygenation 774–775
principle 758
TEE role 11
weaning from 766–767
see also mechanical circulatory support (MCS)
ventricular fibrillation 424–425
management principles 424–425
ventricular inversion 561
see also congenitally corrected transposition of the great arteries (CCTGAs)
ventricular non-compaction 58
ventricular septal defects (VSD) 52, 77, 468, 477–480
adult patients 365
anatomy 477, 478
anesthetic considerations 480
historical background 3–4
incidence 477
inlet defect 54, 277, 276, 478
interrupted aortic arch association 509
mitral atresia with 562–563
muscular defect 277, 276, 478
natural history 478
outlet defect 277, 276
patch leak 283
pathophysiology 478–479
perimembranous defect 52, 60, 277, 276, 478
residual VSD following surgery 531, 733
subarterial/subpulmonary 52, 477
surgical repair 479–480, 479
transcatheter closure 694
transesophageal echocardiography 276–278, 276, 277
transposition of the great arteries and 369–370, 348
see also double outlet right ventricle (DORV), tetralogy of Fallot
ventricular septation 52, 53
defects 52
ventricular septum 77, 78
ventricular tachycardia (VT) 420–422, 698
catecholaminergic polymorphic VT 423–424
long QT syndrome 422–423, 422
management principles 423
monomorphic VT 421, 421
Torsades de pointes 421–422, 421
ventriculoarterial connections 79–80, 80
concordance 79, 80
single-outlet connection 80, 80
ventriculoarterial junction 79
verapamil 428
vertebral artery 212, 213
risk of puncture 213
video-assisted thoracoscopic surgery (VATS), patent ductus arteriosus 471
video-laryngoscopic intubation 440
vinculin 88
visceral situs inversus 73
visceral situs solitus 73
viscerosatrial isomerism 74
vitamins, neuroprotective effects 193
vitelline veins 65
VO2/DO2 balance 376–377, 376
DO2 reduction following surgery 377–379
VO2 increases following surgery 377
volatile anesthetic agents (VAA) 106–110
hemodynamic effects 673
neuroprotection 197
see also specific agents
Wake Up Safe (WUS) Database 36
warfarin 300, 320
weaning from circulatory support see mechanical circulatory support (MCS)
weaning from ventilation see ventilation
weave network 88
Western Canadian study 244–245
Williams syndrome (WS) 58, 278, 501–502, 502
non-cardiac surgery risk 713
Wilms’ tumor 624, 625
Wolff–Parkinson–White syndrome 61, 417, 417
xenon, neuroprotective effect 194–195
Z disk 88