

Index

- Abdominal distension in lung elastance 345, 346
- Abdominal paradox 27
- N-Acetylcysteine 79–80, 81, 357, 358
- Acinetobacter baumannii*, SDD for 260
- Acute hypoxaemic respiratory failure defined 115
- Acute lung injury (ALI)
- blast injuries 212
 - hypoxaemia, PEEP management of 124–125
 - infants/children 300–301
 - liquid ventilation 228
 - patient assessment 118, 115–119, 120, 197
 - recruitment manoeuvres 131, 219
 - ventilation management
 - HFOV 149–150
 - IRV 125–126
 - modes 215–216
 - overview 214
 - principles 214–215
- Acute necrotizing myopathy 205, 205, 356
- Acute quadriplegic myopathy syndrome (AQMS) 177
- Acute renal failure 156
- Acute respiratory distress syndrome (ARDS)
- APRV therapy 110–112
 - blast injuries 212
 - causes 214
 - CT assessment 265
 - delirium in 169
 - dornase alfa 79–80
 - drugs for 81, 137
 - high tidal volume ventilation in 153–154
 - hypoxaemia, PEEP management of 124–125
 - inertia/friction issues 347, 333–347
 - lung contusions 219
 - nitric oxide as therapy 139
 - oxygen toxicity 270
 - patient assessment 118, 115–119, 120
 - recruitment manoeuvres 118–119, 131, 219
 - trials (*See* ARDS net trials)
 - ventilation management
 - HFOV 127–131, 305–306
 - IRV 125–126
 - liquid 228
 - modes 215–216
 - overview 214
 - principles 214–215, 216
- Acute respiratory failure (ARF)
- clinical presentation 29
 - mechanisms of 24
 - NIV 43, 49–50 (*See also* Non-invasive ventilation (NIV))
 - overview 24, 22–24, 25, 142
- Adaptive support ventilation® 113, 361
- Adrenaline 81
- Adrenergic receptor antagonists 349, 348–349, 350
- Adverse effects/complications
- analgesia 276–280
 - artificial airway management 58, 62–63, 72–73
 - aspiration 242–243, 247, 266
 - aspiration pneumonitis 242–243, 245
 - barotrauma (*See* Barotrauma)
 - benzodiazepines 165, 276–280
 - bronchopleural fistula 252–253, 255
 - cardiovascular effects 271, 272, 277
 - cervical spine damage 245, 243–245
 - dental/soft tissue/laryngeal 243
 - dexmedetomidine 166
 - endotracheal intubation 58, 72–73, 240, 239–240, 242, 246
 - extubation, un-planned 249–250
 - face/lips/oropharynx 245, 246
 - fentanyl 276–280
 - gastrointestinal system 274–276
 - hypotension/hypoxia 239–242
 - incidence data 240
 - laryngeal injuries 248, 247–248
 - left ventricular performance 273
 - lorazepam 165
 - lung injury, ventilator-associated (*See* Lung injury, ventilator-associated)
 - maxillary sinusitis/middle ear effusions 246–247
 - midazolam 165
 - nasopharyngeal airways 243–245, 246–247
 - nasotracheal intubation 315
 - neurological function 277, 276–277, 278, 280
 - NMBAs 171, 176–177, 276–280
 - NSAIDs 181
 - opioid agonists 180
 - opioids 276–280
 - overview 21, 239, 241
 - oxygen toxicity 270, 269–270
 - paralysis 176–177
 - PEEP 125, 126, 198
 - perforations 243
 - pharyngo-laryngeal dysfunction 247
 - pneumothorax 241–242
 - propofol 165–166, 276–280
 - pulmonary vascular resistance 272–273
 - reduction 245, 246
 - regurgitation 242–243, 247, 266
 - remifentanyl 276–280
 - right ventricular performance 272, 274
 - sedation 165–166, 245, 276–280
 - sleep 276, 277, 278, 279, 349, 348–349, 350, 384
 - sufentanil 276–280
 - swallowing dysfunction 247, 247
 - tracheal injuries 243, 249, 248–249
 - tracheostomy (*See under* Tracheostomy)
 - trauma 43

Index

- Adverse effects/complications (*cont.*)
 VAP (*See* Ventilator-associated pneumonia (VAP))
 venous return 271–272, 273
 VIDD (*See* Ventilator-induced diaphragmatic damage (VIDD))
 withdrawals 278, 276–278, 280
- Aerial transport issues in low P_{O₂} 13
- Aeromedical transportation issues 290, 294, 293–294, 295
- Aerosol drug delivery
 factors affecting 85
 metered dose inhalers 83, 84
 method selection 83
 nebulizers (*See* Nebulizers)
 overview 81, 80–81, 82
- AIDS 359–360
- Airway collapse, risk factors 1–4
- Airway development, upper 297
- Airway obstruction
 children 298, 306
 Heliox 232
 hypotension/circulatory collapse 205–206
 management 311, 363, 362–363, 364
 pathophysiology 197, 196–197, 198, 363
 pneumothorax 206–207
 problems associated with 196, 203
 tracheostomy 78, 311, 312, 319
 tracheostomy/tracheobronchial suctioning 78
- Airway patency 363, 362–363, 364
- Airway pressure, increasing 122, 123
- Airway pressure release ventilation (APRV)
 applications of 122, 123
 described 110–112, 113
 inspiratory time prolongation by 126–127
- Airway protection 364, 365
- Airway resistance, in infants/children 298–299
- Alfentanil 62–63
- ALI. *See* Acute lung injury (ALI)
- Almitrine bismesylate, for \dot{V}/\dot{Q} mismatch 137
- Alternative recruitment hypothesis 254
- Alveolar-arterial difference calculation 116–119
- Alveolar dead space defined 143–145
- Alveolar shunts in low P_{O₂} 14–15
- Alveoli
 development of 296–297
 diffuse haemorrhage 137, 137, 139
 functional anatomy 3, 4
 minute volume increase/pH 350, 350, 351
- oxygenation of, surface area in 122, 121–122
 pressure mechanics 5, 4–5, 9–11, 268
 recruitment
 in lung elastance 346, 345–346
 in muscle contraction 353
 surfactant dysfunction 267, 265–267
 surfactant in 6, 4–6, 9, 267
 \dot{V}/\dot{Q} ratios 15, 120–121, 136, 133–136, 139
 ventilation inequality in low P_{O₂} 15–16, 17
 wall stress, inspiration and 266
- Amikacin 81, 256–257
- Aminoglycosides 256–257
- Aminophylline 201, 360
- Aminosteroid NMBA agents 174, 175–176
- Anaesthesia, history of
 pneumothorax 392–394
 sealed airway 390–392
- Anaesthetic ventilator modes 88–90
- Analgesia
 acetaminophen 180
 adverse effects 276–280
 as delirium risk factor 168–169
 monitoring 178
 NSAIDs 180, 181
 opioid agonists 168–169, 179, 178–179, 180
 overview 178
- Anatomical dead space defined 143–145
- Androgens 359–360
- Antadir 376–377
- Anti-cholinergic drugs
 asthma/COPD 200
 mucus production, decreasing 80
 primary post-ventilation apnoea 334–336
- Anti-depressants 348–350
- Anti-fibrinolytics 137
- Anti-pyretics 148
- Antibiotic resistance 261
- Anticholinesterases 334–336
- Antimuscarinics 81
- Antipsychotics 170–171
- Anxiety 349, 348–349, 350
- APACHE II model, hyperoxia 270, 271
- Apnoea
 in infants/children 299–300
 primary post-ventilation 336, 334–336
 secondary 340, 339–340
 ventilation 106
- Aprotinin 137
- APRV. *See* Airway pressure release ventilation (APRV)
- AQMS (acute quadriplegic myopathy syndrome) 177
- ARDS. *See* Acute respiratory distress syndrome (ARDS)
- ARDSnet trials
 lung injury, ventilator-associated 263–265
 NMBA usage 171
 PEEP 124, 125, 146, 216, 267–269
 permissive hypercapnia 153, 154, 155
 ventilation modes 215
- ARF. *See* Acute respiratory failure (ARF)
- Arginine 190
- Aripiprazole 170–171
- Arterial blood gas measurement 29–30
- Arterial oxygen content, calculating 119
- Artificial airway management, lower active HMEFs 74
 aerosol drug delivery 80–83
 complications 72–73 (*See also* Adverse effects/complications)
 HMEFs 74, 75
 hot water humidifiers 74–75
 humidification 74
 mucoactive agents 78–80
 overview 72–73
 tracheobronchial suctioning 75–78
 tube exchange 83
 tubing, monitoring 83–85
- Artificial airway management, upper breathing system care
 cuff deflation 71
 cuff inflators, manual 70
 cuff pressure control 71, 69–71
 oral hygiene 72
 securing, of tube 69, 67–69
 sub-glottic secretion drainage 72, 71–72, 262
- Combitube 56, 57
 complications 58, 62–63, 72–73 (*See also* Adverse effects/complications)
 cricoid pressure application technique 63
 drugs/venous access 62–63
 endotracheal tubes (*See* Endotracheal intubation)
 equipment 59, 60–61
 indications 58
 LMAs 56, 57
 monitoring 59
 nasopharyngeal airways 55, 56
 oropharyngeal airways (*See* Oropharyngeal airways)
 overview 54, 55
 oxygenation 58–59, 60, 61, 62
 placement 57–58

- suction apparatus 61–62
 tilting bed/trolley 61
 tube cutting technique 66
 ventilator 63
- Artificial lungs 227–228
- Aspiration
 as adverse effect 242–243, 247
 foreign body, in infants/children 297
 gastric residual volumes and 188–189
 lung transplantation 224–225
 meconium aspiration syndrome 81, 303–304
 pulmonary, risk factors 242
 tidal volume and 266
 transportation issues 287
 VAP transmission via 257, 258–261
- Aspiration pneumonitis 242–243, 245
- Assessment, of need
 arterial blood gases 29–30
 availability principle 22
 clinical 23, 29, 25–29, 30, 144
 diaphragmatic function 27
 hypercapnia 22–25, 26
 lung volume measurement 27
 maximal inspiratory pressure 27
 neurological disorders 30
 overview 21
 patient categories 22–25
 pulse oximetry 28, 27–28, 29
 quality/length of life principle 22
 rate/tidal volume 26–27
 reversibility principle 21–22
 support, goals of 25
 thoraco-abdominal motion 27
- Assist pressure control mode 108, 109
- Assist volume control mode 108, 109
- Asthma
 acute necrotizing myopathy 205, 205
 airflow obstruction,
 pathophysiology 196–198
 circulatory collapse 206, 205–206
 clinical presentation 198, 199
 management
 aminophylline 201
 bronchodilators 149
 cysteinyl leukotriene modifiers 201
 dornase alfa 79–80
 follow-up 207
 glucocorticoids 80
 Heliox 231, 234
 lactic acidosis 200–201
 magnesium sulphate 201
 mechanical ventilation 203,
 202–203, 204
 NIV 49, 201–202
 PEEP 204
 sodium cromoglycate/nedocromil
 sodium 201
- standard therapy 199–200
 metabolic acidosis/hypercapnia in
 155–156
 muscle fatigue and 24–25
 pneumothorax 206–207
- Astrup, Poul 397–401
- ATC (automatic tube compensation)
 114
- Atelectasis 23–24
- Atracurium
 AQMS and 177
 overview 174–175
 properties 175
 study data 174
- Auer, J. 393
- Augmented diffusion 305–306
- Automatic tube compensation (ATC)
 114
- Automode® 113
- Availability principle 22
- β -blockers 348–350
- Barometric pressure issues in low P_{O_2}
 13
- Barotrauma
 blast injuries 213, 216–217
 causes 253
 clinical presentation 250, 251
 permissive hypercapnia and 154
 pneumothorax and 250–253
 risk factors 101, 126
 RMs and 131
- Basiliximab 224
- Beecher, Henry 393–394
- Beneficial studies, ventilation modes
 215–216
- Benzodiazepines. *See also specific agents*
 adverse effects 165, 276–280
 artificial airway management 62–63
 delirium treatment 170, 348–350
 history of 310
 primary post-ventilation apnoea
 336, 334–336
 as sedatives, overview 163–164, 178
 withdrawals 278
- Benzylisoquinolinium NMBA agents
 174–175
- Bert, Paul 269
- Beta 2 adrenergic agonists
 asthma/COPD 137, 199–200, 202
 bronchospasm 81
 gastroesophageal reflux 274–275
 in hypercapnia management 149
 lactic acidosis 200–201
- Beta-lactams 256–257
- Bicarbonate retention 156
- BiPAP (bi-level pressure support) 378
- Bispectral index (BIS) monitor 162
- Bjørneboe, Mogens 397–401
- Blast injuries
 barotrauma 213, 216–217
 bronchopleural fistula 213
 classification 213
 clinical presentation 212, 213–214
 diagnosis 211–212
 explosions, physics of 210
 incidence 212–213
 outcomes 217
 primary described 210–211, 213
 quaternary described 211
 radiographic findings 213
 secondary described 211
 sucking chest wounds 213
 systemic effects of 217
 tertiary described 211
 treatment
 ECMO 217
 fluid administration 217
 overview 214
 PIP/permissive hypercapnia
 216–217
 ventilatory strategy, long-term 214
- Blast waves 210
- Blast wind 210
- Blast zone anatomy 211
- Blease, John 395, 394–395
- Blease Pulmoflator 394–395
- Blood, gas exchange 9–11
- Blood perfusion in low P_{O_2} 16–17, 18
- Bohr effect 146–147
- Bohr equation 145
- Both, Edward 396–397
- Both Respirator 396–397
- Bott COPD/NIV study data 45
- Brauer, Ludolph 393
- Breathing
 expiratory cycling 90–91
 features of 89, 88–89, 90, 95
 inspiratory cycling described 90
 muscle contraction in 351–352
 periodic 299, 299, 300, 340
 respiratory cycle 89, 88–89, 90
 spontaneous 90, 95, 105, 107
 triggered 90, 94–95, 105, 107
- Breathing system care
 cuff deflation 71
 cuff inflators, manual 70
 electronic cuff pressure controller 71,
 70–71
 foam-filled HVLP cuff 70
 Lanz inflation balloon 70, 71
 oral hygiene 72
 securing, of tube 69, 67–69
 sub-glottic secretion drainage 72,
 71–72, 262
- Brochard COPD/NIV study data 45

Index

- Bronchi/bronchioles, functional anatomy 3, 3, 4
 Bronchiolitis 304–305
 Bronchodilator therapy 149
 Bronchopleural fistula 252–253, 255
 Bronchospasm 26, 81
 Burns
 incidence/pulmonary complications 217–218
 overview 217
 oxygen delivery methods 33–34
 transportation issues 287
 treatment 218, 218
 BURP manoeuvre 60–61
 Buscopan (hyoscine butylbromide) 80
 Buspirone 348–350
- Cabin altitude 294–295
 Caffeine, for apnoea in infants/children 299–300
 Calcineurin inhibitors, post-transplant immunosuppression 224
 CAM-ICU (Confusion Assessment Method for the ICU) 168, 167–168, 169
 Cannulae, ECGE 152–153
 Capnography 59
 Carbapenems 256–257
 Carbicarb 156
 Carbocisteine 79–80
 Carbon dioxide
 balance, arterio-venous 143, 146–147
 children/infants, sensitivity to 299–300
 clearance
 alveolar/pulmonary 14–15, 19, 143–146
 dead space 18, 143–145
 ECGE 152–153
 Heliox 231
 by HFOV 127–131
 by HFV 150
 overview 17–20, 142, 156–157
 by PEEP 145–146
 sodium bicarbonate and 154–156
 tidal volume/frequency 145, 347–351
 overview 142
 production 143, 144, 148
 transport, in blood 146–147, 199
 Carbon dioxide narcosis 28, 147
 Cardiogenic pulmonary oedema
 CPAP 39–43, 289–290
 hypoxaemia and 23
 NIV study data 49
 NIV *vs.* CPAP 42–43
 Cardiovascular system development 298
- Catheters
 endotracheal 61–62, 76
 pressure issues 76, 77
 TGI 151, 150–151, 152
 tracheobronchial 76–77
 withdrawal 77
 CCV (critical closing volume) 268
 Central fatigue 356–358
 Cervical spine damage 245, 243–245
 Chest drain, insertion technique 254
 Chest trauma
 blunt, ventilation strategies 219
 diagnosis 219
 drain insertion technique 254
 pathogenesis 219
 Chest wall development 297–298
 Cheyne-Stokes breathing 339–340
 Children
 airway development, upper 297
 airway obstruction 298, 306
 bronchiolitis 304–305
 cardiovascular system development 298
 chest wall development 297–298
 choanal atresia 300, 302
 congenital diaphragmatic hernia 302–303, 304, 305–306
 consent issues 307–308
 control of breathing 299–300
 CPAP 289–290, 300
 CPAP/NIV 301–302
 dornase alfa 79–80
 head injuries 306
 HFOV 305, 305, 306
 HFV 150
 humidification 307
 hyaline membrane disease 136
 liquid ventilation 228
 lung development in 296–297
 lung mechanics in 300–301
 muscle fatigue in 297–298, 307
 nitric oxide therapy 304
 oxygenation assessment in 118
 permissive hypercapnia 301
 physiology 299, 298–299
 sepsis 307
 ventilation of 301
 Chlordiazepoxide 310
 Chlorhexidine 261
 Choanal atresia 300, 302
 Chronic obstructive pulmonary disease (COPD)
 acute necrotizing myopathy 205, 205
 airflow obstruction, pathophysiology 196–198
 in ARF 24
 circulatory collapse 206, 205–206
 clinical presentation 198–199
 high airways resistance, factors affecting 106
 hypercapnia, oxygen-induced 35–36
 management
 aminophylline 201
 CPAP *vs.* NIV 43, 201–202
 cysteinyl leukotriene modifiers 201
 follow-up 207
 glucocorticoids 80
 Heliox 231, 234
 lactic acidosis 200–201
 magnesium sulphate 201
 mechanical ventilation 203, 204, 204, 205
 NIV 49, 201–202, 380–381, 385
 sodium cromoglycate/nedocromil sodium 201
 standard therapy 199–200
 muscle fatigue and 24–25
 NIV issues 46–47
 NIV study data 43–44, 45, 45, 46, 380–381, 385
 pneumothorax 206–207
 therapy targets 384
 Ciaglia, Pasquale 322
 CIM (critical illness myopathy) 356
 CIP (critical illness polyneuropathy) 353–355
 Ciprofloxacin 256–257
 Circulatory collapse 206, 205–206
 Cisatracurium
 overview 174–175
 properties 175
 study data 172–173, 174
 vs. vecuronium 175–176
 Clarithromycin 80
 Clonidine 278, 279
 CMV. *See* Continuous mandatory ventilation (CMV)
 Co-operative binding 117
 Colistin 81
 Combitube 56, 57
 Compound unit conventions xiv, xiv
 Confusion Assessment Method for the ICU (CAM-ICU) 168, 167–168, 169
 Congenital diaphragmatic hernia 302–303, 304, 305–306
 Consent issues, infants/children 307–308
 Continuous mandatory ventilation (CMV)
 described 104, 108–112
 post-transplant 222–223
 Continuous positive airway pressure (CPAP)
 administration 37–38, 39

- airway circuit pressure fluctuations
 40
 in APRV 126–127
 bi-level mode 109–110, 111
 bronchiolitis 304–305
 cardiogenic pulmonary oedema
 42–43
 children 300, 301–302
 circuit/reservoir 40
 clinical use 42
 COPD 43, 202, 204–205
 cuff deflation 71
 indications/contraindications 30, 44
 interfaces 39
 OSAHS 42, 43
 overview 37–39, 44
 physiological effects 41, 39–41, 42
 pneumonia 43–44
 post-operative patients 44
 in transportation 289–290
 trauma 42, 43
 Contractility, diaphragmatic 339, 360
 Conversion factors, pressure xiv
 Cor pulmonale 43
 Corticosteroids
 AQMS 177
 extubation protocol 364, 365, 367
 inflammation 81
 neuromuscular conduction
 dysfunction 355
 Coughing in secretion clearance
 364–367
 CPAP. *See* Continuous positive airway
 pressure (CPAP)
 Crafoord, Clarence 393–394
 Cricoid pressure application technique
 63
 Cricothyroidotomy 327–328
 Critical care patients
 carbon dioxide production in 143
 endotracheal intubation 58, 57–58
 energy requirements 184–185
 over-feeding 185
 protein requirements 186
 sedation of (*See* Sedation)
 tube exchange 83
 Critical closing volume (CCV) 268
 Critical illness myopathy (CIM) 356
 Critical illness polyneuropathy (CIP)
 353–355
 CTraCh LMA 56
 Cuff inflators, manual 70
 Cuffed tubes 325–326
 Cyanide poisoning 120
 Cycle time 88
 Cycling
 expiratory 90–91
 inspiratory, described 90
 overview 88
 Cyclopropane 392
 Cyclosporine, post-transplant
 immunosuppression 224
 Cysteinyl leukotriene modifiers,
 asthma/COPD 201
 Cystic fibrosis 79–80, 81
 Cytokines 153–154, 265–267, 270
 Cytopathic hypoxia 120
 Daclizumab 224
 Dalziel, John 395–397
 Day-time somnolence 43
 De-cannulation
 airway patency 363, 362–363, 364
 airway protection 364, 365
 indications 362
 protocol 368, 367–368
 secretion clearance 366, 364–366,
 367
 as tracheostomy complication
 318–319
 Dead space
 calculation of 18
 elements of 143–145
 infants/children 300–301
 TGI and 151, 150–151, 152
 weaning and 351
 Delirium
 benzodiazepines 170, 348–350
 defined 167
 dexmedetomidine 164–165
 diagnosis 168, 167–168
 haloperidol 170–171
 outcomes 169, 349, 348–349, 350
 prevention/treatment 169–171
 risk factors 168, 168, 169, 349,
 348–349, 350
 and ventilation weaning 348–350
 Dental plaque in VAP transmission
 260–261
 Deoxyhaemoglobin
 in CO₂ transport 199
 Depolarizing NMBA agents 174
 Depression 349, 348–349, 350
 Dexmedetomidine
 adverse effects 166
 in delirium management 168–169
 overview 164–165
 properties 163
 Dextran 79
 Diaphragm
 contractility 339, 360
 function measurement 27
 hernia, congenital 302–303, 304,
 305–306
 tension-time index 359
 Diazepam
 primary post-ventilation apnoea
 336, 334–336
 as sedative 162
 Diffuse alveolar haemorrhage
 described 137, 137
 RM therapy 139
 Diffusion
 augmented 305–306
 coefficient, in oxygenation 132
 limitation in low P_{O₂} 14, 10–14, 16
 in oxygen transfer 10, 117
 oxygenation, distance in 121, 133
 Dornase alfa 79–80, 81
 Double cannula tubes 326–327
 Doxacurium 175
 Dräger Oxylog 3000 289, 290, 291
 Drinker, Philip 396, 396
 Drinker Respirator 396–397
 Drugs/venous access 62–63
 Duchenne muscular dystrophy (DMD)
 377, 379–380
 Duty cycles 88–90
 Dynamic compliance 8, 7–8, 9
 Dynamic hyperinflation 196–198,
 206–207
 Eaton–Lambert syndrome 355
 ECCOR 152
 ECGE (extra-corporeal gas exchange)
 152–153
 ECMO. *See* Extracorporeal membrane
 oxygenation (ECMO)
 Edema. *See* Oedema
 EELV. *See* End-expiratory lung volume
 (EELV)
 Electrolyte imbalance disorders
 355–358
 Electronic cuff pressure controller
 70–71
 Emphysema 296–297, 318
 End-expiratory lung volume (EELV).
See also Functional residual
 capacity (FRC)
 defined 9
 diaphragmatic contractility 339, 360
 gas-trapping and 346, 338–346, 347
 inspiration effects on 266, 338
 Endocrine disorders 355–358
 Endotracheal cuff puncture 316–318
 Endotracheal intubation
 additional channel tubes 66–67, 68
 adverse effects/complications 58,
 72–73, 240, 239–240, 242, 246
 armoured/reinforced tubes 66–67,
 69
 asthma 49
 bronchiolitis 304–305
 catheter issues 61–62, 76

Index

- Endotracheal intubation (*cont.*)
 COPD 44–45
 CPAP *vs.*, study data 42–43
 critically ill patients 58, 57–58
 cuff types 66, 70
 defined 54, 55
 difficult, incidence data 240
 HMEFs 74, 75
 indications 58
 infants/children 298–299
 NIV weaning, study data 47–48
 occluded tubes 65
 one lung ventilation tubes 66–67
 oral *vs.* nasal 63–65
 placement, confirmation signs 242
 propofol 164
 PVC cuffs/tubes 314, 324
 re-intubation, post-NIV 48–49
 securing, of tube 69, 67–69
 size/length issues 65, 65, 66
 sub-glottic secretion drainage 72, 71–72, 262
 suction arrangement 78
 trauma 43
 tube cutting technique 66
 tube exchange 83
 tube resistance, compensation for 114
 tube types 64
 tubing, monitoring 83–85
- Engström, Carl-Gunnar 397, 398
- Enteral nutrition
 cessation, indications 189
 gastric residual volumes 188–189
 indications 187
 interruptions 189
 overview 186
 and parenteral 187–188
vs. parenteral 187
 pre- *vs.* post-pyloric 188
 protocols 188
 as therapy 148
- Enzyme inhibitors, post-transplant immunosuppression 224
- EPAP. *See* Expiratory positive airways pressure (EPAP)
- Ephedrine 62–63
- Epiglottitis 306
- Equipment dead space defined 143–145
- Erythromycin 80, 189
- Ether 390
- Etomidate 62–63, 162, 239, 246
- Expiratory cycling
 described 89, 90–91
 flow-dependent 90–91, 93
 pressure support in 106
- Expiratory positive airways pressure (EPAP). *See also* Continuous positive airway pressure (CPAP)
 airway pressure measurement 38
 NIV *vs.* CPAP 198, 202
 optimal level issues 47
- Expiratory time described 88–90
- Explosions, physics of 210
See also Blast injuries
- Extracorporeal gas exchange (ECGE) 152–153
- Extracorporeal membrane oxygenation (ECMO)
 blast injury treatment 217
 interventional assist devices 227
 post-transplant 226–227
 principles 227
- Extubation
 airway patency 363, 362–363, 364
 airway protection 364, 365
 CNS pathologies in 351–352
 failed 368
 indications 362
 protocol 364, 365, 367
 secretion clearance 366, 364–366, 367
 un-planned, as adverse effect 249–250
- Face masks
 CPAP 39
 overview 33–35
 oxygen delivery 34, 36, 50
- Fastrach™ (intubating) LMA 56
- Fatigue. *See* Muscle fatigue
- Feeding, practical aspects. *See also* Nutritional support
 enteral/parenteral (*See* Enteral nutrition; Parenteral nutrition)
 gastric emptying, delayed 189
 gastric residual volumes 188–189
 interruptions 189
 overview 186
 protocols 188
 route 187
 timing 186–187
- Fell-O'Dwyer apparatus 392–393
- Fenestrations, in tubes 327
- Fentanyl
 adverse effects 276–280
 artificial airway management 62–63
 overview 179
 properties 179
- Ferryl-haemoglobin 211
- Fick's Law 120
- FiHe (fractional inspired helium concentration) 230, 232–234
- Fish oil 190–191
- Fleisch pneumotachograph 233–235
- Flow-dependent expiratory cycling 90–91, 93
- Flumazenil 164, 334–336
- Fluoroquinolones 256–257
- Foam-filled HVLP cuff 70
- Foreign body aspiration, in infants/children 297
- Fractional inspired helium concentration (FiHe) 230, 232–234
- Fractional inspired oxygen concentration (FiO₂)
 aeromedical transportation calculations 294, 294, 295
 delivery 33
 factors affecting 12–13, 28, 27–28, 29
 Heliox 233, 232–233, 234
 HFOV settings 127–131
 notation xiii
 oxygen toxicity and 270, 271
 partial pressure of inspired oxygen 132
 recruitment manoeuvres 131
- France, HMV in 376–377
- FRC. *See* Functional residual capacity (FRC)
- Frenckner, Paul 393–394
- Frog breathing (glossopharyngeal breathing) 374–375
- Functional residual capacity (FRC). *See also* End-expiratory lung volume (EELV)
 asthma/COPD-related airflow obstruction 197, 196–197, 198
 CPAP effects on 39–42
 defined 9
 diaphragmatic contractility 339, 360
 infants/children 300–301
- Furosemide 153
- Gallbladder, ventilation's effects on 275
- Gas exchange
 carbon dioxide clearance 17–20
 low oxygen partial pressure, causes 12–17
 oxygen uptake 9–11
 resistance, increased 346–347
- Gas-trapping 340, 338–340, 346, 347
- Gases
 density/viscosity 231
 flow patterns 230–232
 pressure mechanics 231, 233–235
- Gastric regurgitation, reduction of 60–61
- Gastroesophageal reflux 274–275
- Gentamicin 81, 355
- Giertz, K. H. 393–394

- Gillick competence 308
 Glossopharyngeal breathing (frog breathing) 374–375
 Glottic injuries 247–248
 Glucocorticoids 80
 Glutamine 190
 Glyceryl trinitrate, RV failure post-transplant 226
 Glycopyrrolate 80, 334–336
 Gram-negative organisms, drugs for 81
 Granulomas 248
 Growth hormone therapy 359–360
 Guedel's airways 55, 54–55
 Gueugniaud burn treatment 218, 218
 Guillain-Barré syndrome 27, 353, 355
- Haemoglobin
 carbon dioxide affinity 146–147, 199
 co-operative binding by 10, 117
 Haemoglobin oxygen saturation in arterial blood
 dissociation curve 11, 12, 115, 116
 factors affecting 116, 115–116, 117
 notation xiii
 pulse oximetry measurement of 28, 27–28, 29
Haemophilus influenzae 256–257, 306
 Haldane effect 146–147
 Haloperidol 170–171
 Harvey, William 389
 Head injuries, in children 306
 Heart
 left ventricular failure 43, 273, 339–340
 right ventricular failure 225–226, 272, 274
 Heat and moisture exchange filters (HMEF)
 active HMEFs 74
 humidification 74, 75
 overview 74
 random controlled trials 75
 in VAP transmission 75, 262
 Heliox
 airway obstruction 232
 application, non-intubated patients 232
 application, ventilated patients 233, 232–233, 234
 application principles 230–232
 asthma management 231, 234
 carbon dioxide clearance 231
 contra-indications 232
 COPD management 231, 234
 cost issues 231–236
 density/viscosity 231
 FiO₂ and 233, 232–233, 234
 future prospects 236
 mode of delivery 232
 overview 230
 respiratory disorder management 232
 respiratory disorders 232
 risks/side effects 234–235
 study data 234
 tumours and 232
 ventilator issues 232, 233, 231–233, 234, 235
 Helium 231, 230–231, 232
 Heparin 81
 HFOV. *See* High frequency oscillatory ventilation (HFOV)
 High-frequency oscillatory ventilation (HFOV)
 airway pressure, increasing 122, 123
 ARDS management 127–131, 305–306
 carbon dioxide clearance by 127–131
 children 305, 305, 306
 described 128, 127–128, 129, 131, 149–150
 High frequency ventilation (HFV) 149–150
 High-volume low-pressure (HVLP) cuff 66, 67, 73, 72–73
 History of ventilation
 anaesthesia/pneumothorax 392–394
 anaesthesia/sealed airway 391, 390–391, 392
 benzodiazepines 310
 Blease, John 395, 394–395
 Blease Pulmoflator 394–395
 cuffed tubes 391, 390–391, 392
 Drinker, Philip 396, 396
 Drinker Respirator 396–397
 Fell-O'Dwyer apparatus 392–393
 HMV 376, 374–376, 377
 intensive care medicine ix–x
 iron lungs 373, 372–373, 393, 396–397
 long-term 372–373, 383
 long-term ventilation 372–373, 383
 negative pressure ventilation 372–373, 395–397
 NIPPV 377–379
 NIV 377–379
 orotracheal intubation 391, 390–391, 392
 polio epidemics ix, 32, 372–373, 398, 395–398, 401
 PPV 373, 389, 388–389, 390, 393–394, 401
 prehistory 388–390
 Scandinavia 1949–1952 397–401
 Spiropulsator 394, 393–394
 thoraco-abdominal cuirass 375, 374–375, 396
 timeline 399
 tracheostomy 310, 316, 388
 HMV. *See* Home mechanical ventilation (HMV)
 Home mechanical ventilation (HMV)
 COPD 380–381, 385
 future issues 385
 history, early 376, 374–376, 377
 OHS 381–382
 organization 381, 384–385
 patient selection 379–382
 PPV 377–379
 quality of life issues 383–384
 therapy targets 384
 Hooke, Robert 388–389
 Hot water humidifiers 74–75
 Humane Societies 389
 Humidification
 active HMEFs 74
 aerosol drug delivery 80–82
 artificial airway management 74
 HMEFs 74, 75
 hot water humidifiers 74–75
 infants/children 307
 mucus water content, increasing 79
 overview 74
 VAP transmission 75, 262
 Hunter, John 389
 HVLP (high-volume low-pressure) cuff 66, 67, 73, 72–73
 Hyaline membrane disease 136
 Hybrid mode
 described 95–96, 108–112
 suppression 96
 synchronization 97
 Hydrocortisone 205
 Hydroxydione 310
 Hyoscine butylbromide (buscopan) 80
 Hyper-metabolism, causes 350, 353–355
 Hypercapnia
 aetiology 143
 assessment 22–25, 26
 bronchodilator therapy 149
 carbon dioxide narcosis 28
 chronic, factors affecting 202
 effects of 147, 153–154
 inflammation and 153–154
 iPEEP and 337–340
 management
 Carbicarb 156
 CO₂ production, lowering 148
 ECGE in 152–153
 HFV in 149–150
 overview 147–148, 149
 permissive 150, 153–154

Index

- Hypercapnia (*cont.*)
 pulmonary therapies, adjunctive 149
 sodium bicarbonate 154–156
 TGI in 151, 150–151, 152
 THAM in 156
 ventilation, conventional 148–149
 neonates/infants/children 301
 over-feeding 185
 oxygen-induced 35–36, 199–200
 permissive
 ARDSnet trials 153, 154, 155
 barotrauma and 154
 blast injury treatment 216–217
 children 301
 contra-indications 150
 described 153–154
 management 150, 153–154
 metabolic alkalosis and 153–154
 randomized controlled trials 153, 154, 155
 reduction of 145
 Hypercapnic respiratory failure defined 142
 Hyperinflation, static/dynamic 196–198, 206–207
 Hypertonic saline 79
 Hypertriglyceridaemia 165–166
 Hyperventilation therapy, indications for 333
 Hypocalcaemia, ionized 147
 Hypocapnia
 effects of 147
 management 147
 neonates/infants/children 301
 Hypotension 202, 206, 205–206, 239–242
 Hypothermia, induced as therapy 148
 Hypoventilation issues in low P_{O_2} 13–14, 133
 Hypovolaemia 130
 Hypoxaemia
 assessment 22–25, 115–120
 barometric pressure in 132
 COPD 47
 CPAP 42
 mechanisms/management 120–121
 nitric oxide as therapy 139
 oxygen delivery methods 33–34
 PEEP management of 124–125
 perfusion and 16–17
 post-operative patients 44
 prone position as therapy 139
 tracheobronchial suctioning 75–76, 77–78
 trauma-induced 43
 West's zones 18
 Hypoxia 239–242, 299–300, 337–340
- Hysteresis aetiology 9, 7–9
- Ibsen, Bjorn ix, 397–401
- Ibuprofen 180
- ICAM-1 activation, hypercapnia and 153–154
- ICM (intensive care medicine) ix–x
- IL-8 activation, hypercapnia and 153–154
- Imipenem 256–257
- Immune modulating mixes 191
- Immuno-suppressed patients 49–50, 253–255
- Immunonutrition
 arginine 190
 glutamine 190
 immune modulating mixes 191
 insulin therapy, intensive 191–192
 omega-3 fatty acids 190–191
 overview 189
- Immunosuppression, lung transplantation 224, 224
- Infants
 airway development, upper 297
 airway obstruction 298, 306
 cardiovascular system development 298
 chest wall development 297–298
 control of breathing 299–300
 CPAP/NIV 301–302
 humidification 307
 lung development in 296–297
 lung mechanics in 300–301
 muscle fatigue in 297–298, 307
 nitric oxide therapy 304
 physiology 299, 298–299
 ventilation of 301
- Infections
 antibiotic-resistant, risk factors 257
 control, during transportation 287–288
 Heliox and 232
 nosocomial, propofol-induced 165–166
 respiratory tract isolation 256
 stomal, tracheostomy 319
- Inflammation
 corticosteroids 81
 hypercapnia and 153–154
 lung injury, ventilator-associated 265–267
- Inspiratory cycling described 89, 90, 92
- Inspiratory motive force
 multiparameter controls 100, 102, 101–102, 103
 overview 88, 96–99
 pressure as drive 93, 94, 98, 101, 102
 volume as drive 91, 94, 98, 99–101
- Inspiratory positive airway pressure (IPAP) 202–204
- Inspiratory time described 88–90
- Insufflation anaesthesia 390–392
- Insulin therapy, intensive 191–192
- Intensive Care Delirium Screening Checklist 167–168
- Intensive care medicine (ICM) ix–x
- Intensive care ventilator modes 88–90
- Intermittent positive pressure ventilation (IPPV) 289, 314
- Intermittent ventilation described 104, 373–374
- Intra-pulmonary shunts in low P_{O_2} 14
- Intrinsic fatigue 356–358
- Intrinsic positive end-expiratory pressure (iPEEP) 39–42, 339, 337–339, 340
- Inverse-ratio ventilation (IRV)
 applications of 122, 123
 inspiratory time prolongation by 125–126
- IPAP (inspiratory positive airway pressure) 202–204
- iPEEP (intrinsic positive end-expiratory pressure) 339, 337–339, 340
- IPPV (intermittent positive pressure ventilation) 289, 314
- Ipratropium bromide
 asthma/COPD 200
 bronchiolitis 304–305
 mucus production, decreasing 80
- Iron lungs 373, 372–373, 393, 396–397
- IRV. *See* Inverse-ratio ventilation (IRV)
- Ketamine
 asthma/COPD 202
 intubation/airway management 240, 246
- Ketorolac 180
- Kinetic therapy 260
- Klebsiella pneumoniae*, SDD for 260
- Labetolol 348–350
- Lactic acidosis 200–201
- Lanz inflation balloon 70, 71
- Large bowel, ventilation's effects on 275
- Laryngeal mask airway (LMA) 56, 57
- Larynx
 functional anatomy 1
 injuries 243, 248, 247–248
 swelling, assessment of 363, 362–363, 364
 visualizing, in infants/children 297
- Lassen, Henry 397–401
- Lavoisier, Anton 389
- Left ventricular failure 43, 273, 339–340

- Length of stay data 332
 Leroy technique 390
 Lignocaine 81
 Linoleic acid 190–191
 LIP (lower inflection point) 268, 267–268, 269
 Liquid oxygen (LOX) 288
 Liquid ventilation 228
 Liver, ventilation's effects on 275
 LMA (laryngeal mask airway) 56, 57
 Long, Crawford 390, 390
 Long-term ventilation, history 372–373, 383 *See also* Home mechanical ventilation (HMV)
 Lorazepam
 adverse effects 165
 as delirium risk factor 168, 168, 169
 vs. haloperidol 170
 primary post-ventilation apnoea 336, 334–336
 properties 163
 vs. propofol 164
 as sedative, overview 163–164
 LoTrach™ tube 259
 Lower, Richard 389
 Lower inflection point (LIP) 268, 267–268, 269
 LOX (liquid oxygen) 288
 Lung contusions 219
 Lung injury, ventilator-associated
 ARDSnet trials 263–265
 children 301
 lung mechanics role in 267–269, 274
 overview 263–265
 pathophysiology 267, 265–267
 recruitment manoeuvres 268–269
 volume *vs.* pressure 265, 268
 Lung transplantation
 airway anastomosis leak/stenosis 223–224
 artificial lungs 227–228
 aspiration 224–225
 challenges 223
 double *vs.* single 225
 ECMO (*See* Extracorporeal membrane oxygenation (ECMO))
 immunosuppression 224, 224
 independent ventilation 225
 interventional assist devices 227
 liquid ventilation 228
 overview 222–223
 pleurodesis 224
 right ventricular failure 225–226
 spontaneous breathing, post-transplant 222–223
 indications (*See* Assessment, of need)
 length of stay data 332
 neuromuscular control of 332
 peak inspiratory pressures 264
 Meconium aspiration syndrome 81, 303–304
 Mecysteine 79–80
 Meltzer, S. J. 393
 Metabolic acidosis
 acute renal failure 156
 hypercapnia and 155–156
 sodium bicarbonate for 155
 weaning and 350, 350, 351
 Metabolic alkalosis
 permissive hypercapnia and 153–154
 primary post-ventilation apnoea 336
 Metaclopramide 189
 Metaraminol 62–63
 Metered dose inhalers (MDIs) 83, 84
 Methohexitone 310
 Methylprednisolone, post-transplant immunosuppression 224
 Methylxanthines 360
 Microcuff™ endotracheal tube 259
 Midazolam
 adverse effects 165
 artificial airway management 62–63, 246
 primary post-ventilation apnoea 336, 334–336
 properties 163
 as sedative, overview 163–164
 Minute volume dividers 88–90
 Mivacurium 355
 Mixed venous oxygen saturation
 calculating 119–120
 reduction, in hypoxaemia 133, 134–135
 Modes, of ventilation
 adaptive support ventilation® 113, 361
 assist pressure control 108, 109
 assist volume control 108, 109
 automation of 112–113
 Automode® 113
 back-up system 96
 bi-level 111, 109–111, 112
 breath types and 95, 94–95, 96
 expiratory cycling 90–91
 hybrid 96, 95–96, 97, 108–112
 in hypercapnia management 148–149
 inspiratory cycling 90
 inspiratory motive force (*See* Inspiratory motive force)
 mandatory breath 94, 105, 104–105
 multiparameter controls 101–103
 overview 88, 103, 377–379
 Lungs
 artificial 227–228
 blood flow, poorly ventilated 199
 collapsed 136
 compliance 8, 7–8, 9, 42
 development 296–297
 elastance
 abdominal distension in 345, 346
 alveolar recruitment in 346, 345–346
 increased 343
 oedema in 344, 342–344, 345, 346
 pain relief in 345, 346
 pleural disease in 345, 346
 posture in 345, 346
 pulmonary vascular congestion in 344, 342–344, 345, 346
 surfactant in 341–346
 elasticity 4–9
 function, assessment 115–120
 functional anatomy
 airways 3, 1–3, 4
 alveoli/blood supply 3, 4
 gas-trapping in 340, 338–340, 346, 347
 mechanics
 infants/children 300–301
 pulmonary 5, 4–5, 7, 9
 oxygen transfer 10, 9–10, 11
 oxygenation of, surface area in 122, 121–122
 perfusion in low P_{O₂} 16–17, 18
 recruitable forms 268–269
 size issues 298–299
 volumes 9, 27
 Lymphoma 232, 363
 Macrolides 80
 Magill, Ivan 391, 391, 392
 Magnesium 355
 Magnesium sulphate 201
 Management strategy, factors affecting 361
 Mandatory breath modes 94, 105, 104–105
 Mannitol 79
 Matas, Rudolf 392–393
 Maxillary sinusitis/middle ear effusions 246–247
 Maximal inspiratory pressure
 measurement 27
 MDIs (metered dose inhalers) 83, 84
 Mechanical ventilation
 adverse effects/complications (*See* Adverse effects/complications)
 goals of 25
 Heliox (*See* Heliox)
 history (*See* History of ventilation)

Index

- Modes, of ventilation (*cont.*)
 respiratory cycle settings 88–90
 SmartCare® 113–114, 361
 spontaneous breath (*See also*
 Continuous positive airway
 pressure (CPAP))
 assist control 109
 bi-level 109–110, 111
 described 90, 95, 105, 107, 108,
 377–379
 SIMV 110
 tracheostomy 378–379
 triggered breath
 assist control 109
 bi-level 109–110, 111
 described 90, 94–95, 105, 107,
 106–107, 108, 377–379
 hybrid mode 95–96
 SIMV 110
 tube resistance, compensation for
 114
 weaning and 361
 Monoclonal antibodies,
 post-transplant
 immunosuppression 224
 Montelukast 201
 Morphine
 as delirium risk factor 168–169
 overview 178–179
 properties 179
 Morton, William 390
 Motor neuron disease (MND) 377,
 379–380
 Mouth, ventilation's effects on 274–275
 MPM model, hyperoxia 270
 MRI transfers, intra-hospital 291–293
 MRSA 81, 256–257, 260
 Mucoactive agents
 mucus production, decreasing 80
 mucus water content, increasing 79
 overview 78–79
 polymer cross-linkage reduction
 79–80
 Mucus production, decreasing 80
 Muscle contraction 352, 351–352, 353
 Muscle fatigue
 as adverse effect 333
 assessment of 29–30
 asthma/COPD and 24–25
 defined 24–25, 357, 356–357, 358
 in infants/children 297–298, 307
 Muscle mass 359–360
 Muscle training 359
 Myasthenia gravis 27, 355
 Mycophenolate mofetil, post-transplant
 immunosuppression 224
 Myopathy
 acute necrotizing 205, 205, 356
 acute NMBAs 172–173
 AQMS 177
 CIM 356
 drug-related 355–358
 thick filament 356
 Myositis 355–358
 Naloxone 180, 334–336
 Narcotics, monitoring 178
 Nasal cannulae 34, 33–34, 35
 Nasopharyngeal airways
 complications 243–245, 246–247
 overview 55, 56
 Nasotracheal intubation
 bronchiolitis 300, 304–305
 complications 315
 in VAP transmission 261
 Nebulizers
 jet 82
 mucus water content, increasing 79
 overview 82
 polymer cross-linkage reduction
 79–80
 ultrasonic 82
 vibrating mesh 82
 Nedocromil sodium, asthma/COPD
 201
 Negative pressure ventilation
 described 97
 history 372–373, 395–397
 HMV 374–377
 Neomycin 355
 Neonates
 airway development, upper 297
 cardiovascular system development
 298
 chest wall development 297–298
 congenital diaphragmatic hernia
 302–303, 304
 CPAP/NIV 301–302
 HFOV 305–306
 nitric oxide therapy 304
 ventilation of 301, 302
 Neostigmine 334–336
 Neural fatigue 356–358
 Neurological disorders 30
 Neurological function, ventilation's
 effects on 276–280
 Neuromuscular blocking agents
 (NMBAs). *See also specific agents*
 acute necrotizing myopathy 205
 adverse reactions 171, 176–177,
 276–280
 aminosteroid agents 174, 175–176
 AQMS 177
 asthma/COPD 203
 benzylisoquinolinium agents
 174–175
 CO₂ production, reduction of 148
 in CO₂ production lowering 148
 depolarizing agents 174
 indications 171, 333
 inspiratory time prolongation
 125–126
 mechanism of action 173–174
 monitoring 171–172
 non-depolarizing agents 174
 overview 172–173, 175
 primary post-ventilation apnoea
 336, 334–336
 study data 172–173
 Neuromuscular conduction 335, 355
 Neuromuscular disorders, NIV therapy
 379–380, 384
 Neuromuscular transmission fatigue
 356–358
 NF-κB activation 153–154, 270
 NIPPV. *See* Non-invasive positive
 pressure ventilation
 Nitric oxide
 infants/children/neonates 304
 RV failure post-transplant 226
 as therapy 139
 Nitrogen, density/viscosity 231
 NIV. *See* Non-invasive ventilation
 (NIV)
 NMBAs. *See* Neuromuscular blocking
 agents (NMBAs)
 Non-invasive positive pressure
 ventilation (NIPPV) 30,
 377–379 *See also* Non-invasive
 ventilation (NIV)
 Non-invasive ventilation (NIV)
 ARF 43, 49–50
 asthma/COPD 49, 201–202
 benefits/limitations 54, 377, 379,
 382–384
 cardiogenic pulmonary oedema
 42–43
 children 301–302
 contra-indications 201
 COPD and 35–36, 43, 46–47
 COPD management via 49, 201–202,
 380–381, 385
 COPD study data 43–44, 45, 45, 46,
 380–381, 385
 delivery, practical aspects 47, 50–51
 history 377–379
 NM disease 379–380
 OHS 381–382
 OSAHS 43
 overview 32, 44–45, 51
 post-extubation 368
 post-transplant 222–223
 re-intubation and 48–49
 settings, standard 202

- study data 44–45
 therapy targets 384
 in transportation 289–290
 weaning 47–48
- Non-depolarizing NMBA agents 174
See also specific agents
- Nosocomial infection,
 propofol-induced 165–166
- Novalung 152–153, 227
- NSAIDs
 adverse reactions 181
 mucus production, decreasing 80
 overview 180
- Nuffield, William Richard Morris
 396–397
- Nutritional support
 energy requirements 184–185
 enteral (*See Enteral nutrition*)
 extubation 367
 feeding, practical aspects 186–189
 hypocaloric feeding 185–186
 immunonutrition 189–191
 indications 187
 over-feeding 185
 overview 184, 192–193
 parenteral (*See Parenteral nutrition*)
 protein requirements 186
 status/outcome 184
- Obesity and hypocaloric feeding
 185–186
- Obesity-hypoventilation syndrome
 (OHS) 381–382
- Obstructive sleep apnoea
 hypoventilation syndrome
 (OSAHS) 42, 43
- Obstructive sleep apnoea (OSA) 378,
 384
- Oedema
 cardiogenic/non-cardiogenic 23
 children 307
 in lung elastance 344, 342–344, 345,
 346
 lung injury, ventilator-associated
 265–267
 paralysis and 176–177
- Oesophagitis 274–275
- Oesophagus 243, 274–275
- OHS (obesity-hypoventilation
 syndrome) 381–382
- Olanzapine 170–171
- Omega-3 fatty acids 190–191
- One lung ventilation 66–67
- Opioid agonists. *See also specific agents*
 adverse reactions 180
 as delirium risk factor 168–169
 overview 178–180
 properties 179
- Opioids. *See also specific agents*
 adverse effects 276–280
 artificial airway management 62–63
 gastroesophageal reflux 274–275
 primary post-ventilation apnoea
 336, 334–336
 tidal volumes, poor 336–337
 withdrawals 278
- Oral hygiene 72
- Oropharyngeal airways
 cuff deflation 71
 defined 54
 insertion technique 56
 overview 55, 54–55
 securing, of tube 69, 67–69
- Orotracheal intubation
 history 391, 390–391, 392
 swallowing dysfunction 247
- OSA (obstructive sleep apnoea) 378,
 384
- OSAHS (obstructive sleep apnoea
 hypoventilation syndrome) 42,
 43
- Outlets, for oxygen 58–59, 61,
 285–286
- Oxy-haemoglobin
 in CO₂ transport 199
 dissociation curve 12, 16, 147
 ECGE 152–153
- Oxygen, density/viscosity 231
- Oxygen consumption, calculating
 119
- Oxygen cylinders 62, 288, 293
- Oxygen delivery therapy
 calculations 119, 292
 CPAP *vs.*, study data 42–43
 hypercapnia 35–36
 interface 34, 33–34, 35, 36
 overview 33, 37
 PAO₂/ FiO₂ relationship 33
 safe use 37, 132–133
 target saturations 37
- Oxygen toxicity 270, 269–270, 271
- Oxygenation
 arterial oxygen content, calculating
 119
 artificial airway management 58–59,
 60, 61, 62
 diffusion coefficient 132
 diffusion distance in 121, 133
 ECGE 152–153
 HFOV 127–131
 HFV management 149–150
 hypoxaemia (*See Hypoxaemia*)
 inspiratory time prolongation
 125–127
 low arterial pressure, causes 12–17
 mixed venous oxygen saturation,
 calculating 119–120
 nitric oxide as therapy 139
 overview 10, 9–10, 11, 115, 116
 oxygen consumption, calculating 119
 oxygen delivery, calculating 119
 patient assessment 118, 115–119, 120
 prone position as therapy 139
 recruitment manoeuvres 118–119,
 131
 sigh 132
 surface area in 122, 121–122
 tracheobronchial suctioning 75–76
 \dot{V}/\dot{Q} mismatch 133–139
- Paediatric patients. *See Children;*
Infants; Neonates; Premature
babies
- Pain relief in lung elastance 345, 346
- Pancuronium 175, 355
- Paracetamol 148, 180
- Paralysis
 adverse reactions 176–177
 indications 171
 monitoring 171–172
 overview 171
- Paralytic agents. *See Neuromuscular*
blocking agents (NMBAs)
- Parapac 289
- Parenteral nutrition
vs. enteral 187
 enteral and 187–188
 indications 187
 overview 186
- Partial pressure of carbon dioxide in
 alveolar gas (PACO₂) xiii, 9–11,
 17–20
- Partial pressure of carbon dioxide in
 arterial blood (PACO₂)
 in COPD/NIV monitoring 46–47
 defined 142
 factors affecting 17–20, 29–30
 inspiratory motive force,
 pressure-driven 101
 inspiratory motive force,
 volume-driven 99–101
 management 148
 neonates/infants/children 301
 neurological function and 276–280
 notation xiii
 therapy targets 384
- Partial pressure of carbon dioxide
 (PCO₂) xiii, 299–300
- Partial pressure of inspired oxygen 132
- Partial pressure of oxygen xiii
- Partial pressure of oxygen in alveolar
 gas (PAO₂) xiii, 10, 9–11, 16,
 132

Index

- Partial pressure of oxygen in arterial blood (PaO₂)
 aeromedical transportation
 calculations 294–295
 calculation of 118–119
 changes, surgical
 patients/PPV/anaesthesia 263
 factors affecting 9–11, 142
 FiO₂ relationship 33
 HFOV settings 127–131
 limitations 118–119
 low partial pressure, causes 12–17
 neonates/infants/children 301
 notation xiii
 optimization issues 47
 oxygen toxicity and 270, 271
 Parviox[®] 79–80
 Pathological shunts in low P_{O₂} 14
 Patient–ventilator asynchrony 100
 Patient–ventilator dys-synchrony (PVD) 339, 337–339, 340
 PAV (proportional assist ventilation) 106–108
 PCP pneumonia, drugs for 81
 PEEP. *See* Positive end-expiratory pressure (PEEP)
 Pendelluft aetiology 9, 7–9
 Pentamidine 81
 Perfluorocarbons (PFCs), in liquid ventilation 228
 Perfusion in low P_{O₂} 16–17, 18
 Periodic breathing 299, 299, 300, 340
 Permissive hypercapnia. *See also* Hypercapnia
 ARDSnet trials 153, 154, 155
 barotrauma and 154
 blast injury treatment 216–217
 children 301
 contra-indications 150
 described 153–154
 management 150, 153–154
 metabolic alkalosis and 153–154
 random controlled trials 153, 154, 155
 Pethidine 168–169, 179
 PF ratio 116, 118–119, 270
 pH
 alveolar minute volume increase
 relative to 350, 350, 351
 inspiratory motive force,
 pressure-driven 101
 inspiratory motive force,
 volume-driven 99–101
 permissive hypercapnia 153–154
 Pharyngo-laryngeal dysfunction 247
 Pharynx, functional anatomy 1–4
 Phipps Respiratory Unit 375–376
 Phosphatidylcholine 6, 4–6, 9
 Phrenic nerve damage, breathing
 capacity and 353–355
 Physiological dead space 143–145
 Physiological notation
 key xiii
 overview xiii, xiii, xiv
 Physiotherapy 149
 Piperacillin/tazobactam 256–257
 Pleural disease in lung elastance 345,
 346
 Pneumomediastinum 250–253
 Pneumonia
 aspiration 242–243
 assessment 23–24
 children 303–304
 CPAP 43–44
 gastric residual volumes and 188–189
 ventilator-associated (*See* Ventilator-associated pneumonia (VAP))
 Pneumonitis, aspiration 242–243,
 245
 Pneumopericardium 250–253
 Pneumothorax
 as adverse reaction 241–242
 anaesthesia and, in history 392–394
 asthma/COPD 202, 206–207
 barotrauma 250–253
 blast injuries 213–214
 chest drain, insertion technique 254
 tension 252, 253
 tracheostomy-associated 318
 trauma-induced 43
 in underdeveloped lungs 296–297
 PneuPac series ventilators 289
 Poiseuille's law 299
 Polio epidemics ix, 32, 372–373, 398,
 395–398, 401
 Polyethylene glycol toxicity 165
 Polymer cross-linkage reduction 79–80
 Polyurethane cuffs/tubes 324
 Positive end-expiratory pressure (PEEP). *See also* Continuous positive airway pressure (CPAP)
 Aa difference calculation 118
 airway pressure measurement 38
 applications of 124, 125
 bi-level mode 109–110, 111
 bronchiolitis 304–305
 carbon dioxide clearance and
 145–146
 complications/contraindications
 125, 126, 198
 COPD 204–205
 CPAP, physiological effects 41,
 39–41, 42
 future research directions 269
 history 32
 in hypoxaemia management
 124–125
 infants/children 300–301
 neurological function and 276–280
 physiological 124
 recruitment manoeuvres 131
 right ventricular failure 225–226
 TGI and 151, 150–151, 152
 tidal volumes, poor 336–337
 tracheobronchial suctioning 75–76,
 77–78
 in transportation 289–290
 Positive pressure ventilation (PPV)
 history 373, 389, 388–389, 390,
 393–394, 401
 HMV 374–377
 mechanism of action 9, 7–9
 PaO₂ changes, surgery/anaesthesia
 patients 263
 physiological effects 275
 right ventricular performance effects
 272, 274
 venous return effects 271–272, 273
 Post-surgical patients 44, 164–165
 Posture in lung elastance 345, 346
 PPHN (pulmonary hypertension of the
 newborn) 298, 303–304
 PPV. *See* Positive pressure ventilation (PPV)
 Pranolol 201
 Pregabalin 348–350
 Premature babies 301–302
 Pressure
 airway, increasing 122, 123
 gases, mechanics 231, 233–235
 lung injury, ventilator-associated
 263–265
 lungs, mechanics 5, 4–5, 9–11
 Pressure conversion factors xiv
 Pressure support ventilation (PSV)
 336–337
 Primary post-ventilation apnoea 336,
 334–336
 Procainamide 355
 Prone position as therapy 139, 300–301
 Propanidid 310
 Propofol
 adverse effects 165–166, 276–280
 artificial airway management 62–63
 asthma/COPD 202
 expenditures 279
 overview 164
 properties 163
 Proportional assist ventilation (PAV)
 106–108
 Propylene glycol toxicity 165
 ProSeal[™] LMA 56
 Prostacyclin 81

- Pseudomonas aeruginosa*, SDD for 260
 PSV (pressure support ventilation) 336–337
 Psychological morbidity, ventilation's effects on 276–280
 Pulmonary hypertension of the newborn (PPHN) 298, 303–304
 Pulmonary mechanics overview 5, 4–5, 7, 9
 Pulmonary vascular congestion in lung elastance 344, 342–344, 345, 346
 Pulmonary LTV1000 290, 291
 Pulse oximetry
 in airway management 59
 need assessment via 28, 27–28, 29
 Pulsus paradoxus 199
 PVD (patient-ventilator dys-synchrony) 339, 337–339, 340
- Quality/length of life principle 22
 Quality of life issues 383–384
 Quetiapine 170–171
 Quinine 355
- Rabbit-derived anti-thymocyte globulin (R-ATG) 224
 Radiological maxillary sinusitis (RMS) 261
 Ramsay scale 161
 Rapid shallow breathing index (RSBI) 366
 RASS (Richmond Agitation Sedation Scale) 162, 161–162, 336
 Rate/tidal volume measurement 26–27
 RCT. *See* Randomized controlled trials (RCTs)
 Recruitment manoeuvres (RMs)
 as ARDS/ALI therapy 118–119, 131
 described 131
 as diffuse alveolar haemorrhage therapy 139
 future research directions 269
 ventilator-associated lung injury 268–269
 Reflectance coefficient 344, 342–344, 345
 Remifentanyl
 adverse effects 276–280
 expenditures 279
 overview 179–180
 primary post-ventilation apnoea 336, 334–336
 properties 179
 Renal function, ventilation's effects on 275–276
 Renal replacement therapy (RRT) 350, 350, 351
- Reports, semi-quantitative *vs.* quantitative 256
 Respiration, periodic 299, 299, 300, 340
 Respiratory acidosis
 hypercapnia and 153–154
 sodium bicarbonate for 155, 156
 Respiratory alternans 27
 Respiratory cycle
 described 89, 88–89, 90
 suppression, adverse effects of 333
 (See also Muscle fatigue)
 suppression, indications for 333
 Respiratory disorders, Heliox management 232
 Respiratory quotient 148, 348
 Respiratory rate 88
 Respiratory rate/tidal volume 145, 341, 347–351
 Respiratory syncytial virus (RSV) 81, 304–305
 Respiratory system compliance 8, 7–8, 9
 Respiratory tamponade 198
 Responauts 375–376
 Reversibility principle 21–22
 Reynolds number (RN) 230–232, 346–347
 Rhabdomyolysis 355–358
 rhDNase 79–80, 81
 Ribavirin 81
 Richmond Agitation Sedation Scale (RASS) 162, 161–162, 336
 Right ventricular failure 225–226, 272, 274
 Risperidone 170–171
 RMS (radiological maxillary sinusitis) 261
 Rocking beds 374–375
 Rocuronium
 neuromuscular conduction dysfunction 355
 overview 176
 properties 175
 Rowbotham, Stanley 391, 391, 392
 RRT (renal replacement therapy) 350, 350, 351
 RSBI (rapid shallow breathing index) 366
 RSV (respiratory syncytial virus) 81, 304–305
- Salbutamol
 as asthma/COPD therapy 199–200
 bronchiolitis 304–305
 lactic acidosis 200–201
 SAPS II model, hyperoxia 270
 SARS 50, 81
- Saturation of arterial haemoglobin with oxygen (SaO₂) 115, 118–119
 Sauerbruch, Ferdinand 393
 SBT (spontaneous breathing trial) 361, 360–361
 Schreier on recruitment manoeuvres 219
 SDD (selective decontamination of the digestive tract) 260
 Secretion clearance 366, 364–366, 367
 Sedation
 adverse effects 165–166, 245, 276–280
 in CO₂ production lowering 148
 as delirium risk factor 168–169
 management 166–167
 medications overview 163, 162–163
 (See also specific medications)
 monitoring 161–162
 overview 161, 333
 primary post-ventilation apnoea 336, 334–336
 tidal volumes, poor 336–337
 Selective decontamination of the digestive tract (SDD) 260
 SensorMedics 3100B 128, 129, 130
 Sepsis
 assessment 26, 119–120
 children 307
 and CO₂ production 144, 148
 CPAP, study data 44
 critical illness myopathy 356
 as delirium risk factor 168
 ECMO 226–227
 fish oil 190–191
 insulin therapy, intensive 191–192
 laryngeal injuries 247–248
 nasal intubation 65
 paralytic agents and 173
 Severe pulmonary hypertension 150
 Shaw, Louis 396, 396
 Shock 33–34
 Shunting 133–139, 152–153
 Shunts in low P_{O₂}
 alveolar/true 14–15
 anatomical 14
 pathological 14
 total, estimation of 12, 16
 Sigh described 132
 Silicone cuffs/tubes 324–325
 Silver cuffs/tubes 325
 SIMV. *See* Synchronized intermittent mandatory ventilation (SIMV)
 Sleep, ventilation's effects on 276, 277, 278, 279, 349, 348–349, 350, 384
 Small intestine, ventilation's effects on 274–275

Index

- SmartCare® 113–114, 361
 Smith, J. Lorrain 269
 Sockets, for oxygen 58–59, 61, 285–286
 Sodium bicarbonate 154–156
 Sodium cromoglycate, asthma/COPD 201
 Sodium nitroprusside, RV failure post-transplant 226
 Sorkine study, blast injuries/PIP 216–217
 Speaking valves/caps 327
 Spencer, Geoffrey 375–376
 Spinal fatigue 356–358
 Spiropulsator 394, 393–394
 Spontaneous awakening study 166–167
 Spontaneous breath mode
 assist control 109
 bi-level 109–110, 111
 described 90, 95, 105, 107, 108, 377–379 (*See also* Continuous positive airway pressure (CPAP))
 SIMV 110
 Spontaneous breathing, post-transplant 222–223
 Spontaneous breathing trial (SBT) 361, 360–361
Staphylococcus aureus 256–257
 Starling equation 344, 342–344, 345
 Static compliance 8, 7–8, 9
 Static hyperinflation 196–198
 Steroids, intravenous 200
 Steroids, parenteral 205
 Stomach, ventilation's effects on 274–275
Streptococcus pneumoniae 256–257
 Stridor, post-exubation 363, 362–363, 364
 Stroke and oxygen toxicity 270, 271
 Sub-glottic secretion drainage 71–72
 Succinylcholine 174
 Suction apparatus 61–62
 Sufentanil 276–280
 Supply capacity determinants
 CNS 351–352
 muscle contraction in 352, 351–352, 353
 muscle function, improving 358–360
 Supraglottic airways
 Combitube 56
 defined 54
 LMA 56
 nasopharyngeal 55
 oropharyngeal 55, 54–55
 Supreme™ LMA 56
 Surface area, in oxygenation 122, 121–122
 Surface tension, in alveoli 5, 4–5, 9
 Surfactant
 in alveoli 6, 4–6, 9
 ARDS/meconium aspiration management 81
 development of 296–297
 dysfunction 267, 265–267
 hyaline membrane disease 136
 in lung elastance 341–346
 Suxamethonium 240, 240, 241, 246, 355
 Swallowing dysfunction 247, 247, 320–321
 Sylvester technique 390
 Synchronized intermittent mandatory ventilation (SIMV)
 asthma/COPD 204–205
 described 108–109, 110
 in transportation 289–290
 triggered breaths in 95
 T-cell inhibitors, post-transplant immunosuppression 224
 Tacroe cuff pressure controller 70–71
 Tacrolimus, post-transplant immunosuppression 224
 Tension-time index 359
 TGI (tracheal gas insufflation) 151, 150–151, 152
 THAM (tromethamine) 156
 Thick filament myopathy 356
 Thiopentone 239
 Thoraco-abdominal cuirass 375, 374–375, 396
 Thoraco-abdominal motion measurement 27
 Tidal volume/frequency in CO₂ clearance 145
 Tilting bed/trolley 61
 TLC (total lung capacity) 9
 Tobramycin 81
 TOF (train-of-four) testing 172, 335
 Tossach, William 389
 Total lung capacity (TLC) 9
 Trachea
 functional anatomy 1–3
 injuries 243, 248–249, 318
 stenosis 249, 249, 320
 Tracheal gas insufflation (TGI) 151, 150–151, 152
 Tracheal intubation 54, 286–287
 Tracheal stenosis 249, 249, 320
 Tracheo-innominate artery fistula 319–320
 Tracheobronchial suctioning
 airway obstruction 78
 catheter issues 76–77
 indications 75
 open *vs.* closed 77–78
 overview 75
 oxygenation 75–76
 Tracheostomy
 in airway securement 57–58
 benefits/limitations 377, 382–384
 complications
 airway obstruction 78, 311, 312, 319
 de-cannulation 318–319
 early/late 317, 318–321
 overview 315, 311–315, 316, 317
 perioperative 317, 316–317, 318
 stomal infection 319
 swallowing dysfunction 320–321
 tracheo-innominate artery fistula 319–320
 defined 54
 equipment, bedside 328
 glottic injuries 247–248
 history of 310, 316, 388
 home-use 383
 indications 311, 313
 mini/cricothyroidotomy 327–328
 risk/benefit ratio 314, 311–314, 316
 techniques
 overview 321
 percutaneous 311, 321, 323, 322–323, 324
 single dilator 324
 surgical 322, 321–322
 timing 311–316, 360–361
 tube resistance, compensation for 114
 tubes, choosing 318, 325, 324–325, 326, 327
 VAP transmission via aspiration 258–261
 ventilation modes 378–379
 Train-of-four (TOF) testing 172, 335
 Tranexamic acid 137
 Trans-laryngeal intubation 314, 311–314, 315, 316
 Transmural pressure 7, 272
 Transplantation, of lungs. *See* Lung transplantation
 Transportation issues
 aeromedical 290, 294, 293–294, 295
 equipment/procedures 286, 285–286
 hazards/risks 285, 284–285, 287
 indications/contra-indications 284, 285
 infection control 287–288
 intra-hospital/MRI transfers 291–293
 manual ventilation 290–291
 monitoring 286, 285–286
 need assessment 285
 oxygen supplies 288, 292
 patient preparation 286–287
 tracheostomy 316

- transport ventilators 289, 288–289, 290 (*See also specific types by name*)
- Trauma
 barotrauma (*See Barotrauma*)
 cervical spine damage 243–245
 chest (*See Chest trauma*)
 complications 43
 CPAP 42, 43
 endotracheal intubation 43
 oxygenation via tracheobronchial suctioning 75–76
- Triggered breath mode
 assist control 109
 bi-level 109–110, 111
 described 90, 94–95, 105, 107, 106–107, 108, 377–379
 in hybrid mode 95–96
 SIMV 110
- Tromethamine (THAM) 156
 True shunts in low P_{O_2} 14–15
 Tube cutting technique 66
 Tumors, Heliox and 232
 Type 1 respiratory failure defined 142
 Type 2 respiratory failure defined 142
- Uni-Vent Eagle TM754 290, 291
 Unit conventions xiv, xiv
- Van den Berghe study, insulin therapy 191–192
 Vancomycin 81, 256–257
 VAP. *See Ventilator-associated pneumonia (VAP)*
- Vasodilators, RV failure post-transplant 226
- Vecuronium
 AQMS 177
 neuromuscular conduction dysfunction 355
 overview 175–176
 properties 175
- Venous blood, gas exchange 9–11
 Ventilation inequality in low P_{O_2} 15–16, 17
 Ventilation/perfusion (\dot{V}/\dot{Q}) mismatch
 focal alveolar ventilation causes 136
 infants/children 300–301
 in oxygenation 136, 133–136, 139
 prone position as therapy 139
 in underdeveloped lungs 296–297
- Ventilation requirements, calculation of 17–20
 Ventilator-associated lung injury. *See Lung injury, ventilator-associated*
- Ventilator-associated pneumonia (VAP)
 aetiologies 71–73, 75, 83–85, 253–255
 diagnosis 256, 255–256
 prevention 72, 75, 258, 257–258
 risk factors/outcome 255, 257, 259, 262–263
 transmission
 via aspiration 257, 258–261
 breathing circuit 72, 262
 horizontal 261–263
 humidification 75, 262
 sub-glottic secretion drainage 72, 71–72, 262
 treatment 256–257
- Ventilator-induced diaphragmatic damage (VIDD)
 overview 269, 332, 356
 oxygen, safe levels of 270–271
 oxygen toxicity 269–270
- Ventipac 289
 Venturi principle 34, 36
 Vesalius, Andreas 388, 389
 VIDD. *See Ventilator-induced diaphragmatic damage (VIDD)*
- Villar study, PEEP 216
 Volume-targeted constant flow mechanical ventilation pressure/time profile 9
 Volume-targeted pressure control (VPC) ventilation 104–105, 106
 Volumetric CT scanning trial, PEEP 125
 VPC (volume-targeted pressure control) ventilation 104–105, 106
- Waters system 291, 290–291, 398
- Weaning
 apnoea
 primary post-ventilation 336, 334–336
 secondary 340, 339–340
 de-cannulation (*See De-cannulation*)
 dead space 351
 defined 331
 extubation (*See Extubation*)
 first stage 332–340
 gas-trapping 340, 338–340, 346, 347
 initiation, timing of 331–332
 lung elastance, pulmonary vascular congestion in 344, 342–344, 345, 346
 metabolic acidosis 350, 350, 351
 metabolic alkalosis 336
 muscle training 359
 NIV 47–48
 patient–ventilator dys-synchrony 339, 337–339, 340
 protocols 361–362
 second stage 341, 360–361
 speaking valves/caps 327
 tidal volumes, poor 336–337, 348
 time requirements 331
 ventilation, neuromuscular control of 332
 work of breathing determinants (*See Work of breathing determinants*)
 West's zones 16–17, 18, 145, 146
 White card test 366
 Work of breathing determinants
 dead space 351
 delirium (*See Delirium*)
 diaphragmatic contractility 339, 360
 elastance, increased 343, 346
 emotional factors 349
 FRC/CPAP effects on 39–42
 inertia/friction 347, 333–347
 metabolic acidosis 350, 350, 351
 overview 342
 pneumonia 23–24
 resistance, increased 346–347
 respiratory rate/tidal volume 145, 341, 347–351
 supply capacity
 CNS 351–352
 muscle contraction in 352, 351–352, 353
 muscle function, improving 358–360
 muscle function disorders 355–358
 neuromuscular conduction 335, 355
 peripheral neuropathies 350, 354, 353–354, 355
- Zafirlukast 201
 Ziprasidone 170–171