## Index

### A
- Accelerated partial breast irradiation (APBI), 173
- Achy pain, 337
- Acquired radioresistance, 58
- Acrylic mould, 184
- Actinomycin D post-radiotherapy, 328
- Active beam delivery, 259
- Active breathing control (ABC), 72–73
- Active matrix flat-panel imagers (AMFPi), 104
- Acute emesis, 280
- Acute reactions, 301–302
- Adaptive radiotherapy, 231–232
  - anatomical changes, studies on, 232
  - clinical rationale, 233–234
  - timing, 234
    - image registration, 234
    - offline adaptive radiotherapy, 235
    - online image-guided adaptive radiotherapy, 236
    - real-time adaptation, 236–237
- Adductors, DNA, 30
- Adjuvant radiotherapy, 24
- Adjuvant therapy, role of, 344, 345
- Adrenergic agonists, 345
- Adriamycin, 325
- Air gaps, correction, 214
- Alignment laser, 68
- Alpha foeto-protein (AFP), 12
- Amifostine, 295
- Aminoglycosides, 352
- Amorphous silicon detectors, 167
- Amoxicillin-clavulanate, 352
- Anaemia, 283, 349, 351
- Angiogenesis, 296
- Angiotensin-converting enzyme (ACE), 295
- Anthropometric evaluation, 371
- Antandrogens, 294
- Antibiotic prophylaxis, 353
- Antibiotic therapy
  - barrier nursing methods, 353
  - indication for, 353
  - organisms, drugs for, 352
  - thrombocytopenia, management of, 354
- Vancomycin, 352
- Anticipatory emesis, 281
- Anticonvulsant, 334, 345
- Antidepressants, 343, 344
- Antidiarrhoeal drugs, 334
- Antihistaminic drugs, 334
- Antihypertensive drugs, 343
- Antimetabolites, 29
- Antipseudomonal β-lactam agents, 352
- D-arabinofuranosyladenine (ara-A), 296
- Aspirin, 334, 339
- Axesse™, 230

### B
- Barium contrast films, 9
- Beam
  - build-up region, 88
  - CT-based 3D planning, 86
  - Dmax, 88
  - exit dose, 88
  - field matching
    - plan check/resimulation, 102
    - treatment information, 102
  - generation, 251
  - image registration
    - anatomical and physiological imaging, 85, 86
    - clinical awareness, 85
    - combined anatomic-functional studies, 85
    - contour matching registration, 85
    - interactive registration, 85
    - point-based registration, 85
    - tumour mapping, 85
Beam (cont.)
  isocentre, 87
  manual beam definition, 84
  modifiers
    BEV, 94
    bolus, 91, 92
    compensating filter, 92, 93
    depth dose distribution, 90
    effective attenuation coefficient
      method, 94
    isodose shift method, 92–94
    TAR method, 94
    wedge filters, 90
  multiple coplanar beams
    fields, 101
    four-field technique, 98
    three-field box, 100
    wedge pair, 97
  multiple noncoplanar beams, 101
  normalization, 95
  parallel-opposed beams, 96
  profile
    central region, 88
    penumbral region, 89
    umbra, 89
  rotational techniques, 101
  SAD, 96
  set-up verification
    cone beam CT, 105
    EPID, 104
    kV portal imaging, 104
    MV portal imaging, 104
    OBI system, 105
    portal imaging with films, 103
    portal localization, 103
    portal verification, 104
  SSD, 96
  surface dose, 87, 88
  therapy machines, 89
  treatment planning systems, 84–85
  weighting, 96
Beam’s eye view (BEV), 94
Beamlet, 122
Benzodiazepines, 343, 345
Benzydamine, 318
Bevacizumab, 32
Biochemical analysis, 372
Biochemistry, 13
Biologic cooperation, 266
Biological equivalent dose (BED), 52
Biomolecules, 274, 288, 289
Bioreductive drugs, 293
Bisphosphonates, 345
Bladder point, 198
Bolus, 91, 92, 216
Bone destruction, 337
Bone marrow
  circulating blood cells, radiotherapy on,
    349–351
  haematological toxicities
    anaemia, 351
    initial antibiotic therapy, 352–354
    leucopenia, 351
    neutropenia, 351, 352
  pathophysiology, 349, 350
Bone marrow aspiration and biopsy, 8
Bone marrow toxicities, 282
Bone marrow transplantation (BMT), 371
Bowel toxicities, 334
Brachytherapy
  CT images, 178
  cylindrical mould, 187–188
  delivery, methods of, 172
  dose optimization, role of, 202–205
  DVH, plan evaluation for, 205–207
  ILBT, 202–204
  indications, 172–173
  intracavitary brachytherapy
    after loading applicators, 193
    anatomical position, 196, 197
    bladder point, 198
    dosage guidelines, 201
    HD-ICRT for Ca cervix, 193
    high-dose volume, 201
    ICRU Bladder and rectal
      point, 200, 201
    irradiated volume, 201
    lymphatic trapezoid, 200–201
    Manchester system, 196, 197
    orthogonal films, 193
    Paris technique, 193
    point A and B, position of, 198, 199
    rectal point, 198
    reference volume, 198
    significance, 197
    Stockholm technique, 196
    treated volume, 201
  inverse planning, 204
  inverse square law, 171
  linear moulds, 187
  objectives of, 171
  radiobiology of, 176
    dose rate effect, 174, 175
    HDR brachytherapy, 174, 175
    LDR brachytherapy, 174, 175
    MDR brachytherapy, 174
PDR Pulsed dose rate (PDR) treatment
practical use of, 175–176
window of opportunity, 175
sandwich mould, 186
source, 173–174
surface mould, 184–186
and teletherapy, 171
treatment volumes, definition of, 183–184
3D planning system
CT scans, 179
dose-volume concepts, 179
robotic mechanisms, 180
2D planning systems, 178
Brain tumours, 152
Breakthrough emesis, 281
Breast cancers, 151
Bremsstrahlung, 211
Bromodeoxyuridine, 292
Bystander effect, 296

C
Cachexia, 367
Cancer care
palliative and supportive care, 39, 40
benefits, 41
dealing with difficult situations, 42
globally available, 42
measurement, 40
radiotherapy
chemo-radiation, 24
curative protocols, 24
developments, 25
palliative, 23–24
role, 23–24
safety of, 24
Cancers
paediatric patients, 35
cardinal signs, 35
chemotherapy, 37–38
pretreatment evaluation, 35
radiotherapy, 37
treatment principles, 36
patients
advice, 379
early vs. late-onset
sequelae, 377
follow-up care, 377
follow-up visits, 378
healthcare providers, 377
nutritional care
Nutritional care
patient examination, 378
post-radiotherapy, 377
treatment summary, 379
surgery, 17
cancer emergencies, 20
diagnosis and staging, 18
management, 20
palliative care and rehabilitation, 19
screening and prevention, 17
treatment, 18

Candida species, 318
Cannula, 271
Capecitabine, 281
Carbamazepine, 344
Carbapenem, 352, 353
Carbon ion therapy, 257
active beam delivery, 259
passive beam delivery, 259
radiobiology, 257–259
Carcinoembryonic antigen (CEA), 12
Carcinogenesis, 258
Cefepime, 352
Celecoxib, 339
Cell cycle kinetics, 267
Cell damage, types of, 55
Cell repopulation, 268–269
Cell surface antigens, 12
Cell survival curves, 50
cellular radiation damage, repair of, 53
fractionated radiotherapy, 53
oxygen, LET and RBE, 55
redistribution, 52
reoxygenation, 53
repopulation, 54
Central plane, definition, 202
Central venous access devices (CVAD), 38
Cetuximab, 288, 296
C-factor, 5
Chemo dose adjustments, 283
Chemo-radiation, 24
Chemotherapeutic agents, 292, 294
Chemotherapy, 29, 265
antimetabolites, 29
avoiding prescribing errors, 272–274
biomolecules and, 274, 288
chemo dose adjustments, 283–288
combination therapy, 31
DNA adductors, 30
DNA unwinding, prevention, 30
drug extravasation, management, 274–277
antidotes, 277–278
measurement, 275–277
drug prescribing errors, 273
drugs and duration of infusion, 270
effectiveness, markers of, 31
hormone receptor antagonists, 30
mitotic inhibitors, 30
Chemotherapy (cont.)
  novel agents, 31–32
  paediatric patients, 37
  preparation and administration
cannula, 271
drugs preparation, 270–271
insertion site, 271
procedures, 272
sequencing of, 269
side effects, 278–283
toxicities, 30, 284
Chromosomal aberrations, 50
Ciprofloxacin, 352
Cisplatin, 292, 294, 325
Clindamycin, 352
Clinical radioresistance, 57
Clinical target volume (CTV), 80, 81, 116,
118, 184
Coefficient of equivalent thickness (CET)
  method, 216
Collision sensors, 68
Colpostats, 195
Common Terminology Criteria for Adverse
  Events (CTCAE) grading system, 363
Compensating filter, 92, 93
Complete decongestive therapy (CDT), 363
Complications, during treatment
  acute reactions, 301
  fractionation, effect of, 305
  FSUs, 303
  late responses, 302
  sequelae, 305–307
  subacute responses, 302
  volume effect, 304
Computed tomography (CT), 10, 11, 69, 112,
178–180, 183
Hounsfield units, 87
simulator, 69, 71
2D planning, 158–160
Computer-based simulation, 65–72
Computer-controlled milling machine,
127–128
Cone beam computed tomography, 223
Cone, electron beam, 217
Conformal radiotherapy
  beams selection, 120–121
  immobilization, 112
  intensity-modulated treatment, delivery,
  127–128
  build-up region, PTV-in-air and dose,
  131–132
  DAO, 129–130
dose calculation algorithms, 130
IMRT plan evaluation, 133
  intensity-modulated arc/volumetric arc
  therapy, 128–129
  plan evaluation and improvement,
  132–133
  planning aims, for IMRT, 130–131
  PTV and OAR/PORV overlap,
  131–132
  PTV and RVR, 132
  3D-CRT plan evaluation, 133
  verification of IMRT, 133
  inverse planning, 121–123
MLCs, 123–127
  patient set-up, 112–114
  principles, 109–111
  contouring, 111
  CT scan images, 111
  immobilization device selection, 111
  IMRT, 112
  3D-CRT planning, 111–112
  simulation, 112
  static vs. dynamic multileaf collimator
delivery, 127
treatment planning, 121
treatment process, 111
treatment volumes and critical organs,
  contouring of
  CTV, 115, 116
deformable image registration
  algorithms, 115
  GTV, 114, 116
  OAR, 117, 118
  PET-based imaging, 119–120
  principles, 115
  PTV1, 116
  3D-CRT treatment planning, 116
Conformity index (CI), 164
Constipation, 344
Continuous Hyperfractionated Accelerated
  Radiotherapy (CHART), 25
Continuous slowing down approximation
  (CSDA), 211
Contour matching registration, 85
Contouring, 111
Conventional simulator, 67
Conventional/2D simulation, 66–68
Conversion rate, 6
Copper/zinc superoxide dismutase (SOD), 360
Cordycepin, 296
Core needle biopsy, 7
Corticosteroids, 334, 360
COX-2 gene, 288
Cryoanalgesia techniques, 345
Cumulative dose-volume histogram, 161
Index

Cut-out, electrons, 218
Cyberknife®, 223, 230
Cyclizine, 334, 341
Cylotrons, 251
Cylindrical mould, 187
Cytosine arabinoside, 30
Cytotoxic enhancement, 266
Cytotoxins, 292

D
Daptomycin, 352
Daunorubicin, 328
Decelerators, 216
Decongestive lymphatic therapy (DCT), 363
Deep inspiration b-hold (DIBH) technique, 73
Deformable image registration algorithms, 115
Deformable registration, 234
Delayed emesis, 281
Delirium, 344
Dental implants, 320
Dental reactions, 313
3′-deoxyadenosine (3′dA), 296
2-deoxy-d-glucose (2-DG), 296
3′-deoxyguanosine (3′dG), 296
Depth of maximum dose (Dmax), 88
Dexrazoxane, 278
Diclofenac, 339
Dicyclomine, 334
Differential dose-volume histograms (DVH), 160, 205, 206
Digitally reconstructed radiographs (DRRs), 120
Dihydrofolate reductase (DHFR), 29
Dimethyl sulfoxide (DMSO), 277, 295
Direct aperture optimization (DAO), 129
Directed dose-volume histogram, 160
Discrete spot scanning (DSS), 253
Distal edge tracking, 255
Distant metastases, IORT, 242
DNA adductors, 30
DNA damage repair, 267
Dnearmax, 206
Dose constraint potentials (DCPs), 204
Dose distribution
- beyond Dmax, 213
- in penile implant, 188, 190
Dose fractionation, 56
Dose homogeneity index, 193
Dose statistics, 156
Dose volume histogram (DVH), 112, 161–163, 178
Dose-rate effect, 56
Double-exposure technique, 167
Double-plane implants, 192
Double-strand breaks (DSBs), 50, 222, 266
Doxorubicin, 328
Drug extravasation, management, 274
- antidotes, 277
- measurement, 275
Duloxetine, 344
Dynamic multileaf collimator delivery, 127
Dynamic wedge, 226

E
Edge effects, 216
Effective attenuation coefficient method, 94
Elastic collisions, 210
Electrolyte, 373
Electron beams, 209–210
- field shaping with, 217–219
- properties, 210–213
- treatment planning with, 214–217
Electron ionization/excitation, 49
Electronic portal imaging device (EPID), 104
Electrostimulation techniques, 346
Embryonal tumour, 35
Endoscopic biopsy, 8
Enteral feeding, 370
Enteral nutrition (EN), 374
Enteritis, 332
Epidermal growth factor receptor (EGFR), 32, 288
Equivalent square field size (EFS), 158
Equivalent uniform dose (EUD), 143
Erlotinib, 296
Etabidazole, 293
Excision biopsy, 7
External beam radiotherapy (EBRT), 197, 242, 328
- dose optimization, 204
IORT, 242
- technique, 245
- treatment sequencing, 244

F
Febrile neutropenia (FN), 350
Field matching
- isocentre/beam entry point, 102
- plan check/resimulation, 102
- treatment information, 102
Filter-free beams, 224
Fine-needle aspiration cytology, 8
Fluid cytology, 8
Fluorescent in situ hybridisation (FISH), 13
Fluoroquinolones, 352, 353
Fluoroscopic portal imaging detectors, 167
5-Fluorouracil, 30, 292
Flush-out technique, 278
Forward planning (FP), 112
4D-computerized tomography scan, 74
Four-field technique, 98
Fractionation, effect of, 305
Frame-based methods, 224
Frozen section, 7
Functional subunits (FSUs), 117, 303, 304, 325, 331
Functional target volumes, 120
Fusion Image registration

G
Gabapentin, 344
Gantry-based linear accelerator system, 222
Gap correction, 149
Gemcitabine, 30, 292, 325
Gene therapy, 295
Gene-directed prodrug therapy (GDEPT), 296
Genito-urinary cancers, 151
Genotyping, 13–14
Geometric penumbra, 89
Germ cell tumours, 152
Gastrointestinal cancer, 151
Gastrointestinal complications
care of reactions, 333–335
clinical importance, 332–333
pathophysiology, 331–332
Gross target volume (GTV), 114, 118
Gross tumour volume (GTV), 80, 116, 183
Gynaecological cancers, 151

H
Haematological toxicities, 351
Haemoglobin, 12
Halogenated pyrimidines, 291, 292
Haloperidol, 334
Hand pendant, 68
Head and neck cancers, 150
Helical tomotherapy, 223
Hepatic/renal derangement, 283
Hi-ART™, 230
High-dose-rate (HDR) brachytherapy,
174, 175
advantage, 114, 177, 178
EBRT dose, 176
PDR, 177
High-risk clinical target volume (HR-CTV), 184, 201
Hinge angle, 90
Histopathological diagnosis, 6–8
Homogeneity index (HI), 164
Hormone receptor antagonists, 30
Hormones, 12
Hot spot, 83
Human recombinant erythropoietin
administration, 283
Hydrocortisone lotion, 329
Hydromorphone, 342
Hyperbaric oxygen (HBO) therapy, 320, 360
Hyposalivation, 314
Hypoxic cell sensitizers, 292

I
Ibuprofen, 339
Image registration, 234, 235
anatomical and physiological
imaging, 85, 86
clinical awareness, 85
combined anatomic-functional studies, 85
contour matching registration, 85
interactive registration, 85
point-based registration, 85
tumour mapping, 85
Imatinib, 296
Imipenem-cilastatin, 352
Immobilization, 62–65, 76
Immunocytochemistry, 9
Impedance-controlled microcurrent therapy, 361
Incision biopsy, 7
Induction chemotherapy, 269
Inelastic collisions, 210
Initial radiation damage, 266–267
Intensity-modulated arc therapy (IMAT), 128
Intensity-modulated proton therapy, 255
Intensity-modulated radiation
therapy (IMRT), 120
conformal radiotherapy, 112, 116
plan evaluation, 133
planning aims for, 130
verification, 133
Intensity-modulated treatment, delivery, 127
build-up region, PTV-in-air and dose, 131
DAO, 129
dose calculation algorithms, 130
IMRT plan evaluation, 133
intensity-modulated arc/volumetric arc
therapy, 128
plan evaluation and improvement, 132
planning aims for IMRT, 130
PTV and OAR/PORV overlap, 132
PTV and RVR, 132
Index

3D-CRT plan evaluation, 133
verification of IMRT, 133
Interactive registration, 85
Intermediate-risk clinical target volume (IR-CTV), 184
Internal margin (IM), 83
Internal risk volume (IRV), 83
Internal shielding, 218
Internal target volume (ITV), 81, 82, 118
International Commission for Radiation Units (ICRU), 80, 81, 139, 198
Interstitial brachytherapy, 173
Interstitial implants
advantage, 188
dose distribution in penile implant, 188, 190
double-plane implants, 192
drawback, 188
ICRU 58 report, 193
low-dose region, 193
mean central dose, 192
Paris system, 192
Paterson-Parker system, 188
planar implant, 188
Quimby system, 192
rigid template breast interstitial implant, 188, 191
single plane lip implant, 188, 189
source positions, in tongue implant case, 188, 191
three-plane tongue implant, 188, 189
two plane flexible penile implant, 188, 190
volume implant, 188, 190
Interventional/image-guided simulation methods, 72
CT scan, gating in, 74
DIBH Manoeuvre, breathing sequence, 73
during treatment, 74
4D-CT scan, 74
gating during simulation, 74
Respiratory Gating, 73
Intracavitary brachytherapy, 173
after loading applicators, 193, 194
anatomical position, 196, 197
bladder point, 198
in cervical cancer, 207
dosage guidelines, 201
HD-ICRT for Ca cervix, 193, 196
high-dose volume, 201
ICRU Bladder and rectal point, 200, 201
irradiated volume, 201
lymphatic trapezoid, 200
Manchester system, 196–198
orthogonal films, 193, 195
Paris technique, 193
point A and B, positions of, 198, 199
rectal point, 198
reference volume, 198
significance, 197
Stockholm technique, 196
tandem and vaginal cylinder, 197
treated volume, 201
Intraluminal brachytherapy (ILBT), 173, 202, 203
Intraoperative electrons (IOERT), 242, 245, 246
Intraoperative irradiation therapy (IORT) dose, 245–246
EBRT with, 242–243
local control
complications, 242
distant metastases, 242
dose influence, 241
patient selection and evaluation, 243–244
technique, 245
treatment sequencing, 244
Intrathecal fentanyl, 343
Intrathecal morphine (ITM), 342
Intrinsic radioresistance, 57
Inverse planning (IP), 116, 121, 204
Inverse square law, 211
Iodine contrast films, 10
Iododeoxyuridine, 292
Ionizing radiation (IR), 49, 52–55
cell damage, types of, 55
cellular DNA, damage to, 50
clinical radioresistance, 57–58
direct and indirect damage pathways, 49–50
dose fractionation, 56–57
linear quadratic function, cell survival and effect, 50–52
cellular radiation damage, repair of, 53–54
fractionated radiotherapy, 53
oxygen, LET and RBE, 55
redistribution, 52–53
reoxygenation, 53
repopulation, 54
Irradiated volume, 83, 201
Irradiation image-guided delivery, 61
Isocentre selection, 87
Isocentric technique, 168
Isodose curves, 156
Isodose distribution, 158
Isodose lines, 158, 159, 215
Isodose shift method, 92
Isotope scan, 10
K
Keratinocyte growth factor-1, 319
Ketamine, 345
Kinase/phosphorylase signalling pathways, 32

L
Laparoscopic biopsy, 7
Lapatinib, 296
Laryngeal reactions, 315
Late-onset osteoradionecrosis, 317
Late responses, 302–303
Leaf motion files, 125
Leaf sequencing, 125
Lethal damage, 55
Leucopenia, 350, 351
Leukemias, 35
Levofloxacin, 352
Li-Fraumeni syndrome, 15
Linear component, 51
Linear energy transfer (LET), 55
Linear moulds, 187
Linear quadratic model (LQM), 50, 222
Linezolid, 352
Lipid requirements, 373
Loperamide, 334, 335
Low-dose-rate (LDR) brachytherapy, 174, 175
advantages, 176
dose rate and treatment time, 175
EBRT doses, 175
PDR, 176, 177
Low-dose region, 193
Lower-energy beams, 212
LQ model, 176
Lung cancers, 151
Lymphatic trapezoid, 200
Lymphoedema, 361
clinical manifestations, 361–362
CTCAE grading system, 363
evaluation and staging, 362
management, 363–364
manual lymphatic drainage, 365
severity of, 363
treatment, indications, 364
Lymphomas, 35, 152

M
Magnetic resonance imaging (MRI), 11, 70, 113–115, 183, 205
Malabsorption syndromes, 333, 334
Malnutrition, 38
Mammography, 10
Manchester system, 195–197
Manual lymphatic drainage, 365
Marx’s staging system, 316
Matched (abutted) electron fields, 219
Matched photon, 219
Matrix ionization chamber detectors, 167
Mean central dose (MCD), 192, 193
Medium-dose-rate (MDR) brachytherapy, 174
Melanomas, 152
Meloxicam, 339
MEN syndromes, 18
Meropenem, 352
Methadone, 342
Metoclopramide, 334
Microvasculature, 32
Misonidazole, 293
Mitotic inhibitors, 30
Monitor units (MUs), 256
Monoclonal agents, 284
Monte Carlo (MC) method, 130
Morphine, 339, 340
oral, alternatives to, 342
prescribed dose of, 341
subcutaneous/intravenous, indications for, 342
Mould brachytherapy, 172
Mould therapy, 184
Mucaine™, 334
Mucosal reactions, 313
Mucosal toxicities, 368
Mucositis, 38, 309
Multileaf collimators (MLCs), 112, 123, 124
focussing, 125
leaf motion files, generation, 125
leaf movement, 126
leaf sequencing, 125, 126
standard collimators and, 124
tongue-and-groove effect, 124
with tongue and groove design, 125
Multiple coplanar beams
four-field technique, 98
multiple fields, 101
three-field box, 100
wedge pair, 97, 98
Multiple noncoplanar beams, 101
Multiple static fields, 128

N
Nausea, 334, 343
Neoadjuvant radiation, 24
Neuroablative techniques, 345
Neuroleptics, 343
Neuropathic pain, 338, 344
Neurosurgical techniques, 346
Neutropenia, 38, 351–353
Nimorazole, 293
Nimotuzumab, 296
Nitromidazoles, 293
Nociceptive pain, 337
Nominal standard dose (NSD), 175
Non-nociceptive pain, 337
Nonsteroidal anti-inflammatory drugs (NSAIDs), 339, 344
Normal tissue complication probability (NTCP), 140, 294
Normal tissue damage, 291, 292
Normalization, 95, 96
Noval therapies, 296
Novalis™, 230
Nutritional care
cachexia, 367
management
anthropometric evaluation, 371
arginine, 373
biochemical analysis, 372
BMT, 371
clinical examination, 371
electrolyte, 373
enteral nutrition, 374
evaluation, 372–373
fluid requirements, 373
glutamine, 373
host immune responses, 373
lipid requirements, 373
nutritional assessment, 371
omega-3 polysaturated fatty acids, 373
parenteral nutrition, 374
protein requirements, 373
radiotherapy/chemotherapy, 371
pathophysiology
anaerobic glycolysis, 368
cancer surgery, 369
carbohydrate metabolism, 369
chemotherapy, 368
lipid metabolism, 370
negative energy balance, 368
protein energy
malnutrition, 367
protein metabolism, 370
radiation therapy, 368
translation, 367
weight loss, 367
Nutritional status, 369
Nutritional therapy, 370
O
Objective functions (OFs), 122
Octreotide, 334
Octreotide, 334, 335
Oesophagitis, 332
Offline adaptive radiotherapy, 235
On-board imaging (OBI) system, 105
Oncofoetal antigens, 12
Ondansetron, 334
Online image-guided adaptive radiotherapy, 236
Opioid therapy, side effects, 343
Oral mucosal reactions
assessing, 311–312
factors, 312
management, 317
care for, 318
dental caries, care, 319
dental extraction, 318
dental implants, 320
loss of taste, care of, 320
ORN, treatment of, 320
mucosal, dental and salivary reactions, 313–316
ORN, 316
pathophysiology, 309–311
scoring system, 311, 313
Oral mucositis, 282, 309, 310
Organ at risk (OAR), 83, 117–120, 141, 163, 164, 205, 206, 227
Oro-pharyngeal fistula, 315
Oropharyngeal mucosal reactions, 317
care for, 318–319
dental caries, care, 319
dental extraction, 318
dental implants, 320
loss of taste, care of, 320
ORN, treatment of, 320
Osteoradionecrosis (ORN), 316, 317, 320
Ovoids, 196
Oxycodone, 342
Oxygen enhancement ratio (OER), 55
Oxygenation, 268
P
Packed red cell transfusion, 283
Paclitaxel, 292
Paediatric patients, cancers, 35
cardinal signs, 35
chemotherapy, 37
pretreatment evaluation, 35
radiotherapy, 37
treatment principles, 36
Index

Pain
achy, 337
adjuvant therapy, 344–345
definition, 337
management, 338
morphine
oral, alternatives to, 342–343
prescribed dose of, 340–341
subcutaneous/intravenous, indications for, 342
neurolabile techniques, 345
neuropathic, 338
nociceptive, 337
non-nociceptive, 337
opioid therapy, side effects, 343–344
palliation by oral medication, 338
pathophysiology of, 337
relief, barriers to, 339–340
somatic, 337
symptoms, 345–346
visceral, 337
WHO analgesic ladder, 339
Palifermin, 319
Palliative care services, 19, 20, 40
benefits, 41–42
dealing with difficult situations, 42–43
globally available, 42
measurement, 40
Pap smear, 8
Paracervical triangle, 196
Parallel-opposed beams, 96, 97
Parenteral nutrition (PN), 374
Paris technique, 193
Passive beam delivery, 259
Passively scattered proton therapy (PSPT), 250, 252
Patch beams, 254
Paterson-Parker system, 188
Patient immobilization, 76
Pencil beamlets, 112
Pentazocine, 339
Pentoxifylline (PTX), 360
Percentage depth doses (PDD)
for oblique beam incidence, 213
for small/large electron field sizes, 213
Permanent implants, 173, 179
Permanent seed implants (PSIs), 174
Personalized medicine, 15
Pethidine, 339
Pharyngeal reactions, 315
Phenothiazines, 334
Photon beam machines, 89
Photon beam therapy, 216
Physical penumbra, 89
Piperacillin-tazobactam, 352
Plan evaluation, 155, 226, 227
algorithm
guidelines, 163–164
target volumes, 163
CI and HI, 164–166
CT-based 2D planning, 158
cumulative DVH, 161
directed dose-volume histogram, 160
dose distribution, normalization of, 169
dose statistics, 156–158
equivalent square field size, 168–169
isocentric set-up, 169
isodose curves, 156
modern planning systems, 169
orthogonal planning planes and isodose surfaces, 156
set-up verification methods, 166–167
treatment time/monitor units, 167, 168
Planar circular mould, 186
Planar implant, 188
Planning organ at risk volume (PORV), 83
Planning target volume (PTV), 82, 115, 116, 184, 206
build-up region, PTV-in-air and dose, 131
and OAR/PORV overlap, 132
and RVR, 132–133
Plaque therapy, 173
Plaster casts, 62
Point-based registration, 85
Polymerase chain reaction (PCR), 13
Polymyxin-colistin, 353
Polymyxin E/tobramycin/amphotericin B (PTA), 319
Polyurethane foam, 64
Port films, 166
double-exposure technique, 167
localization, 166
single-exposure technique, 166
verification, 166
Portal localization, 103
Portal verification, 104
Post-operative radiotherapy, 16
Post radiotherapy cutaneous kelosis, 327
Potentially lethal damage, 55
Potentially lethal damage repair (PLDR), 295–296
Pregabalin, 344
Pretreatment evaluation, 35–36
Primatom™, 231
Proliferation kinetics, 57
Prostate-specific antigen (PSA), 12
Protein energy malnutrition, 367
Protein requirements, 373
Proton beam therapy
  beam generation, 251–253
  biologic properties, 251
  physical properties, 250, 251
  planning algorithm
    dose calculations, 256
    field shaping, 253–254
    patient-specific, 257
    simulation, 253
    target volume definition, 254
    treatment plan evaluation, 255–256
    treatment planning, 254–255
    treatment set-up and delivery, 256
Pruritus, 344
Psychological issues
  communication skills
    training, 386
  emotional and psychological problems, 385
  genetic risk, 384
  interventions, 385
  parenting, 383
  preventive, 387
  psychological distress and disorders, 382–383
  psychological distress screening tools, 386
  psychosocial guidelines, 386
  psychosocial interventions, 387
  quality of life, 382, 387
  reinforcing positive emotional expressions, 387
  sexual relations, 383
  supportive care interventions, 387
  treatment related intervention, 387
Psychological therapy, 387
Pulsed dose rate (PDR) treatment
  computerization and remote afterloading, 177
  HDR brachytherapy, 176
  LDR brachytherapy, 176, 177
  mechanism of, 176
  single-stepping iridium source, 176
Punctate haemorrhages, 334
Pyridoxine, 334

R
  Radiation fibrosis (RF)
    HBO, 361
    impedance-controlled microcurrent therapy, 361
    management options, 359
    medical management, 359–360
    pathophysiology of, 358, 359
    physiotherapy, 361
    post radiotherapy cutaneous kelosis, 357, 358
    risk of occurrence, 357
  Radiation fibrosis syndrome (RFS), 357
  Radiation-induced leukoplaikia, 313
  Radical radiotherapy, 24
  Radiobiology, SRS, 222
  Radiofrequency techniques, 345
  Radioprotectors, 295
  Radioresistant tumours, 291, 292
  Radiosensitization, 267, 292
  Radiosensitizers
    bioreductive drugs, 293–294
    chemotherapeutic agents, 292, 294
    cytotoxins, 292
    halogenated pyrimidines, 291, 292
    hypoxic cell sensitizers, 292, 293
  Radiotherapy, 3
    account treatment disruptions and calculating dose, 149–150
    blood investigations, 12, 13
    dose prescription, 150–153
    dose specification, 139–140
    fractionation schedules, 145–147
    histopathological diagnosis, 6
      bone marrow aspiration and biopsy, 8
      cytologic review, 8
      immunocytochemistry, 9
      tissue biopsy, 6–8
      imaging, 9
      air contrast barium studies, 9
      barium contrast films, 9
      CT scanning, 10, 11
      iodine contrast films, 10
      isotope scan, 10
      mammography, 10
      ultrasound, 11
      X-rays, 9
    OAR, 141–142
    overall treatment time, effect of, 148–149
    sequencing of, 269
    staging, 4
    therapeutic ratio, 140
    tolerance doses, 142–144
    treatment, 14–16, 144–148
    tumour markers, 12

Q
  Quadratic component, 51
  Quantitative Analyses of Normal Tissue Effects in the Clinic (QUANTEC), 144
  Quimby system, 192
Index

Range modulation wheel (RMW), 252
Real-time adaptation, 236
Rectal point, 198
Red cell count (RCC), 12
Reference volume, 198, 202
Rehabilitation, 19
Relative biological effectiveness (RBE), 55, 251
Remaining volume at risk (RVR), 84
Reoxygenation, 53
Repopulation, 54
Respiratory depression, 344
Respiratory gating, 73
Respiratory tracking control, 225
Rigid template breast interstitial implant, 188, 191
Robotic brachytherapy, 180
Robotic linear accelerator system, 223
Rotational techniques, 101
RTOG grading system, 327, 332

S
Salivary reactions, 313
Salivary secretions, 314
Sandwich mould, 186–187
Sarcoma, 35
Scanned beam proton therapy, 255
Scanned beams, 252
Scar assessment, 362
Scatter penumbra, 89
Sedation, 343
Serotonin, 344
Set-up verification
  AMFPIs, 104
  cone beam CT, 105
  EPID, 104
  kV imaging, 104
  MV portal imaging, 104
  OBI system, 105
  portal imaging with films, 103
  portal localization, 103
  portal verification, 104
Shielding, 218
Short-course hypofractionation, 258
Simulation, 65–76
  algorithm, 75–76
  3D/CT, 76
  2D simulation, disease localization, 75–76
  alignment lasers, 68
  computed tomographic simulator, 65–72
  conventional/2D, 66
  CT, 69–72
  interventional/image-guided simulation methods, 72–74
  virtual, 71
  Simultaneous Integrated Boost (SIB), 25
  Single beams, 95
  Single plane lip implant, 188, 189
  Single-exposure technique, 166
  Single-field uniform dose (SFUD), 255
  Single-plane implant, 189, 192
  Single-strand breaks (SSBs), 50, 266
  Skin assessment, 362
  Skin cancers, 152
  Skin erythema, 326
  Skin reactions
    care of, 328–330
    clinical effects, 326–328
    pathophysiology, 325
    radiation recall phenomenon, 328
  Skin sparing, 87
Smearing, 254
Social issues
  emotional and psychological problems, 385
  genetic risk, 384
  parenting, 383
  psychological distress and disorders, 382
  quality of life, 382
  sexual relations, 383
Solid state technology, 104
Somatic pain, 337
Sorafenib, 296
Source-axis distance (SAD) technique, 96
Source-to-skin distance (SSD), 96
Source-treatment surface distance (SSD), 61
Spatial cooperation, 265
Spontaneous osteoradionecrosis, 317
Spread-out Bragg peak (SOBP), 250
Square-/rectangular-shaped moulds, 186
Static multileaf collimator delivery, 127
Stem cell transplantation, 371
Stereotactic body radiotherapy (SBRT), 221–223, 225
Stereotactic radiosurgery (SRS), 221, 222, 224
  patient selection, 224
  planning criteria, 227–229
  radiobiology, 222
  SRT/SBRT, 222–224
  treatment delivery and verification, 227–231
  treatment planning, 225–227
Stereotactic radiotherapy (SRT), 221, 222
Steroids, 334
Stockholm technique, 196
Subacute responses, 302
Subcutaneous fibrosis, 295
Sublethal damage (SLD), 51, 55
Sublethal damage repair, 56
Sucralfate, 318
Sucralfate enemas, 335
Sulfasalazine, 335
Superoxide dismutase enzymes (SODs), 295
Supportive care, 39, 40
  benefits, 41
  difficult situations, dealing with, 42
  globally available, 42
  measurement, 40
Surviving fraction (SF), 56
Symptomatic therapy, 334
Synchrotrons, 251
Synergy S™, 230

T
Tamoxifen, 294
Telangiectasias, laser coagulation of, 334
Teletherapy, 171
Telomeres, 13
Temporal modulation, 266
Therapeutic ratio, 140–141
Thermoplastics, 62, 63
Three-dimensional conformal radiotherapy (3D-CRT), 111, 116, 120, 133
Three-field box, 100
3D planning system
  CT scans, 179
  dose-volume concepts, 179
  robotic mechanisms, 180–181
Three-plane tongue implant, 188, 189
Thrombocytopenia, 350, 354
Tigecycline, 353
Tirapazamine, 293
Tissue biopsy, 6
Tissue inhomogeneity, 215, 216
Tissue-air ratio (TAR) correction method, 94
TNM staging, 5
Tolerance doses, 142
Tongue-and-groove effect, 124
Topoisomerase, 30
Total parenteral nutrition (TPN), 370
Toxicity independence, 266
Toxicity, chemotherapy, 30–31
Transdermal fentanyl, 343
Transmission penumbra, 89
Trastuzumab, 15
Treated volume (TV), 83, 201
Tricyclic antidepressants, 344
Trilogy®, 230
True Beam STx™, 230
Tumour control probability (TCP), 140
Tumour mapping, 85
Tumour markers, 12
Tumour oxygenation, 258
Tumour tracking imaging, 74
Tumour vasculature, 268
2D planning systems, 178
2D simulation, disease localization, 75
Two plane flexible penile implant, 188, 190

U
Ultrasound, 11
Umbra, 89
Urinary retention, 344
Urine urea nitrogen, 372

V
Vacloc immobilization frame, 65
Vacuum-forming mould, 64
Vancomycin, 352, 353
Vascular endothelial growth factor (VEGF), 32, 268, 289
Venlafaxine, 344
Very-low-dose-rate (vLDR) brachytherapy, 174
Virtual simulation, 71
Visceral pain, 337
Volume approach, 198
Volume effect, 304–305
Volume implants, 188, 190
Vomiting, 334, 343

W
Wedge angle, 90
Wedge filters, 90
Wedge pair, 97, 98
Weight loss, 367
White blood counts, 13
WHO analgesic ladder, 337–339, 344
WHO ladder approach, 340
Will-Rogers Phenomenon, 6