

Index

- ablation, local 6, 195, 197–8
 - see also* cryoablation; high-intensity focused ultrasound (HIFU) treatment; percutaneous ethanol injection (PEI); radiofrequency ablation (RFA)
- abscess 68–9, 84–5
 - following cryoablation 193–4
- aflatoxin 2
- alpha-fetoprotein (AFP) 119
 - hepatocellular carcinoma 3
 - screening 4
- angiogenesis 9, 11
 - inhibition 9, 10, 174
 - in colorectal cancer 16
 - see also* blood supply
- arterial tumor vessels 35–7
- Barcelona Clinic Liver Cancer Staging Classification 101, 130–1
- Bernadino needle 111–12
- bevacizumab 11, 17
 - colorectal cancer therapy 16
- biliary complications, cryoablation 195
- billing team 207
- bio-heat equation 151, 169–70
- biopsy
 - hepatocellular carcinoma 3
 - liver metastasis 40
- bipolar electrode arrays 171
- blood flow modulation during radiofrequency ablation 152–3, 173–4
 - heat sink minimization 174
 - tissue perfusion 174
- blood supply 74
 - advanced hepatocellular carcinoma 35–7
 - arterial tumor vessels 35–7
 - portal vein 37
 - sinusoid-like blood spaces 37
 - venous tumor vessels 37
 - pre-liver ablation imaging 45
 - small hepatocellular carcinoma 28–30
 - see also* angiogenesis
- breast cancer metastases 139–40
- capecitabine 14
- capillarization 37
- carcinoembryonic antigen (CEA) level 134–5
- cetuximab 16, 17
- chemoembolization *see* transarterial chemoembolization (TACE)
- chemotherapy 8–9
 - angiogenesis inhibition 9, 10, 16
 - colorectal cancer 14–16, 184
 - downstaging of liver metastases 16–17
 - combination therapy 11–12, 14–16
 - resistance 11–12
 - sorafenib 10–12
 - with thermal ablation 175
 - see also* transarterial chemoembolization (TACE)
- Chiba needle 111–12, 114
- cholangiocarcinoma, differential diagnosis 40
- cirrhosis 2, 108
 - liver metastasis frequency and 38
 - prognosis and 4
 - resection and 108–9
- cisplatin, use in chemoembolization 77
- clinic set-up 205–6
 - see also* radiofrequency ablation (RFA) service
- coagulation necrosis induction
 - bio-heat equation 151, 169–70
 - energy sources 168
 - in radiofrequency ablation 151–2, 168–9
- colorectal cancer (CRC) 17–18, 181–2
 - hepatic metastases 13–17, 133, 181–2, 183–4
 - chemoembolization 82
 - clinical risk score 135
 - radiofrequency ablation 13–14, 160–2
 - surgical treatment 13, 128, 133–5
 - see also* liver metastases
 - systemic therapy 14–16
 - angiogenesis inhibition 16
- communication 208–9
- complications
 - cryoablation 192–5
 - percutaneous ethanol injection 117

214 Index

- complications (cont.)
 - radiofrequency ablation 68–9
 - transarterial chemoembolization 83–5
- computed tomography (CT) 47–50
 - cryoablation monitoring 189, 190–1, 195, 197–8
 - hepatocellular carcinoma 2–3
 - multidetector-row CT (MDCT) 47–50, 51–2, 60–1, 64
 - indications for 50
 - protocols 50
 - percutaneous ethanol injection follow-up 119
 - PET/CT 53, 66–8
 - post-liver ablation follow-up 55, 57–8, 60–1, 66–8
 - residual or recurrent tumor 64
 - radiofrequency ablation guidance 153–7
 - contrast-enhanced imaging 45–7
 - ultrasonography (CEUS) 47, 48
- cracking, liver 193
- cryoablation 185–8
 - ablation zone monitoring 188–91
 - complications 192–5
 - abscess 193–4
 - biliary complications 195
 - hemorrhage 192–3
 - post-ablation syndrome 194–5
 - tumor lysis syndrome (cryoshock) 194
 - tumor seeding 194
 - follow-up 195–7
 - multiple freeze cycles 189–90
 - patient selection 181
 - pneumothorax risk 187
 - post-procedure management 192
 - probe placement 185–8
 - intraoperative 187–8
 - ultrasound guidance 187–8
 - sedation 191
- cryoshock 194
- cytokeratin 7 (CK 7) 40
- cytokeratin 20 (CK 20) 40
- decompensation, hepatic 84
- diffuse fatty change 30
- donor organs 5
- doxorubicin 8
 - use in chemoembolization 77
- dysplastic nodules (DN) 26–7
 - high-grade 26–7
 - low-grade 26
- embolization *see* transarterial chemoembolization (TACE)
- endocrine therapies, hepatocellular carcinoma 9
- epidermal growth factor (EGF) 11
 - inhibition in colorectal cancer 16
- epirubicin, use in chemoembolization 77
- erlotinib 11
- Exablate 98–9
- extrahepatic tumor extension screening 53–4
- 18-F-fluorodeoxyglucose-PET (FDG-PET)
 - extrahepatic tumor extension screening 53
 - post-liver ablation follow-up 67–8
- fibrolamellar carcinoma (FLC) 34
- 5-fluorouracil (5-FU) 14–15
- follow-up 210–11
 - cryoablation 195–7
 - percutaneous ethanol injection 117–19
 - post-liver ablation imaging 55–68
 - expected imaging (complete ablation) 57–61
 - imaging protocol 55–7
 - indeterminate imaging 61–4
 - residual and recurrent imaging 64–5
- gastroduodenal ulceration 85
- gastrointestinal (GI) carcinoids 136
- gastrointestinal stromal tumor (GIST) 139
- gelatin sponge 76–7
- germ cell tumor metastases 140
- hemorrhage 192–3
- hepatectomy *see* resection
- hepatic artery occlusion 85
 - see also* transarterial chemoembolization (TACE)
- hepatic metastases *see* liver metastases
- hepatitis B virus (HBV) 1–2, 100, 108
- hepatitis C virus (HBC) 2, 108
- hepatocellular carcinoma (HCC) 1–12, 18, 25, 99–100, 108, 181, 182–3
 - ablation 6
 - high-intensity focused ultrasound (HIFU) 101–4
 - image-guided 157–60
 - percutaneous ethanol injection (PEI) 6, 109–23
 - radiofrequency ablation 6, 158–60
 - see also specific ablation techniques*
 - advanced HCC 31–4, 35–7
 - angioarchitecture 35–7
 - gross appearance 31–2
 - histology 32–4
 - moderately differentiated 33–4
 - poorly differentiated 34
 - well differentiated 32–3
 - angiogenesis inhibition 9, 10
 - transarterial chemoembolization (TACE) 6–8, 78–81, 102
- chemotherapy 8–9, 10–12
- classification 100, 101, 129–31
- diagnosis 2–3
- diffuse infiltrative 100
- early detection 25
- endocrine therapies 9
- epidemiology 1–2
- etiology 1–2
- liver resection 4, 44, 108–9
- massive type 100
- nodular 100
- pathology 25–37
- premalignant lesions 26–7
- prognosis 4

- radiation therapy 12
- recurrence 8, 64–5, 183
- residual tumor 64–5
- risk factors 2
- screening 3–4, 182–3
- staging 100, 101, 129–31, 148
- surgical treatment 4, 44, 108–9, 127, 128, 129–32, 157–8, 183
 - safety improvements 127–9
 - transplantation 5, 109, 131, 132, 157–8
- variants 34
 - fibrolamellar HCC 34
 - sarcomatoid HCC 34
 - scirrhous HCC 34
- well-differentiated early stage HCC 27–31
 - distinctly nodular type 30
 - evolution to advanced stage 30
 - nodule-in-nodule appearance 30–1
 - vaguely nodular type 27–30
- high-intensity focused ultrasound (HIFU) treatment 92, 104
 - adverse events 103
 - applications 97
 - limitations 103–4
 - liver tumors 101–4
 - metastases 102–4
 - with transarterial chemoembolization 102
 - mechanisms of tissue change 93–4
 - principles 92–7
 - treatment devices and procedures 97–9
- hospital admitting privileges 205
- ice crystal formation 182
 - see also* cryoablation
- image-guided radiofrequency ablation 148–62
 - ablation technique 150–3
 - eligibility criteria 148–50
 - imaging 153–7
 - outcomes 157–62
 - colorectal hepatic metastases 160–2
 - hepatocellular carcinoma 157–60
 - pretreatment assessment 148–50
 - see also* radiofrequency ablation (RFA)
- internal marketing 208
- internally cooled electrodes 171
- Interventional Oncology (IO) 203–4
- irinotecan 14, 15
- leiomyosarcoma, metastatic 139
- lesion enhancement pattern 64
- liver cracking 193
- liver metastases 13–17, 101, 133, 181–2, 183–4
 - biopsy 40
 - chemoembolization
 - colorectal metastases 82
 - neuroendocrine metastases 82–3
 - clinical risk score 135
 - downstaging of 16–17
 - gross appearance 38–40
 - high-intensity focused ultrasound (HIFU)
 - treatment 102–4
 - incidence 37–8
 - cirrhosis relationship 38
 - radiofrequency ablation 13–14, 161
 - image-guided 160–2
 - recurrence 64–5, 136, 184
 - residual tumor 64–5
 - surgical resection 13, 44, 127, 132–40, 141, 184
 - colorectal cancer metastases 128, 133–5
 - neuroendocrine tumor metastases 136–8
 - other tumor metastases 139–40
 - safety improvements 127–9
- liver structure 94
- liver transplantation 5, 109, 132, 157–8
 - eligibility criteria 5, 131, 132
 - neuroendocrine metastases and 138
- magnetic resonance imaging (MRI) 50–2
 - contrast media 51
 - cryoablation monitoring 189
 - hepatocellular carcinoma 2–3
 - percutaneous ethanol injection follow-up 119
 - post-liver ablation follow-up 58, 65
 - protocols 53
 - radiofrequency ablation guidance 153–7
- marketing 207–8
 - external 207–8
 - internal 208
- melanoma, metastatic 140
- metastases *see* liver metastases
- mitomycin-C, use in chemoembolization 77
- Model-JC Tumor Therapy System 99
- multidetector-row computed tomography (MDCT) 47–50, 51–2
 - indications for 50
 - post-liver ablation follow-up 60–1, 64
 - protocols 50
- multipolar electrode arrays 171
- multitine electrode arrays 170–1
- neovascularization 37
- neuroendocrine tumors 136
 - metastases 82–3
 - surgical treatment 136–8
- nolatrexed 8–9
- oily chemoembolization 77–8
- oxaliplatin 14–15, 17
- pale body 34
- palliative therapies 74
 - neuroendocrine metastases 137–8
 - see-also specific therapies*
- pancreatitis 85
- patient management 209–10
- PEIT needle 111–12, 114

216 Index

- percutaneous ethanol injection (PEI) 6, 109–23
 - complications 117
 - equipment 110–12
 - evaluation of effectiveness 117–19
 - indications and contraindications 116–17
 - multimodality therapy 122
 - pretreatment assessments 110
 - procedure 112–15
 - results 120–2
 - recurrence 121–2
 - versus radiofrequency ablation 122, 158
 - volume of alcohol required 115
- perfusion electrodes 171–2
- pneumothorax 187
- polyvinyl alcohol (PVA) 77
 - polymeric beads 87
- portal vein 37
 - occlusion 86
 - see also* blood supply
- positron emission tomography (PET)
 - 18-F-fluorodeoxyglucose-PET (FDG-PET) 53, 67–8
 - extrahepatic tumor extension screening 53–4
 - PET/CT 53–4, 66–8
 - post-liver ablation follow-up 66–8
- post-ablation syndrome 194–5
- post-procedural follow-up *see* follow-up
- postembolization syndrome (PES) 84
- professional team 206–7
- prostate cancer 97
- pseudoglands 33–4
- Quadrifuse needle 112, 114–15
- radiation therapy 12
 - with radiofrequency ablation 175–6
- radiofrequency ablation (RFA) 44–5, 69–70, 150–3, 167
 - bio-heat equation 151, 169–70
 - coagulation necrosis induction 151–2, 168–9
 - complications 68–9, 162
 - contraindications 44–5
 - creating meaningful volumes of ablation 170
 - electrode design modification 170–2
 - algorithms for effective heating 172
 - bipolar/multipolar arrays 171
 - internally cooled electrodes 171
 - multitine arrays 170–1
 - perfused electrodes 171–2
 - eligibility criteria 148–50
 - follow-up 210–11
 - goals of 167–8
 - hepatocellular carcinoma 6, 158–60
 - image-guided 148–62
 - imaging techniques 153–7
 - liver metastases 13–14, 160–2
 - modulating tissue blood flow 173–4
 - heat sink minimization 174
 - tissue perfusion 174
 - modulating tissue characteristics 172–3
 - electrical conductivity 173
 - thermal conductivity 173
 - multimodality therapy 122
 - patient management 209–10
 - post-liver ablation imaging 55–68, 69
 - expected imaging (complete ablation) 57–61
 - imaging protocol 55–7
 - indeterminate imaging (need follow-up) 61–4
 - liver tissue changes 55
 - management strategies 57
 - PET and PET/CT imaging 66–8
 - residual and recurrent imaging 64–5
 - pre-liver RFA imaging 45–54, 69
 - dynamic imaging role 45–7
 - lesion evaluation 47–52
 - liver blood supply 45
 - screening for extrahepatic extension 53–4
 - service set-up *see* radiofrequency ablation (RFA)
 - service
 - synergistic therapies 174–6
 - chemotherapy 175
 - radiation therapy 175–6
 - technique 150–3
 - versus percutaneous ethanol injection 122, 158
- radiofrequency ablation (RFA) service 211
 - billing team 207
 - clinic set-up 205–6
 - communication 208–9
 - hospital admitting privileges 205
 - marketing 207–8
 - patient management 209–10
 - professional team 206–7
 - training 204–5
- Raf/MEK/ERK signaling pathway 10
- referral building 207–8
- renal cell carcinoma metastases 139
- renal failure 85
- reproductive tract tumor metastases 140
- resection 44, 127
 - hepatocellular carcinoma 4, 44, 108–9, 127, 128, 129–32, 157, 183
 - liver metastases 13, 44, 127, 132–40, 141, 184
 - from colorectal cancer 128, 133–5
 - from neuroendocrine tumors 136–8
 - from other tumors 139–40
 - safety improvements 127–9
- sarcoma, metastatic 139
- sarcomatoid hepatocellular carcinoma 34
- scirrhous hepatocellular carcinoma 34
- screening
 - extrahepatic tumor extension 53–4
 - hepatocellular carcinoma 3–4, 182–3
- sedation 191
- sinusoid-like blood spaces 37
- sorafenib 10–12
- stromal invasion 28

- sunitinib 11
- surgical resection *see* resection
- thermal ablation *see* radiofrequency ablation (RFA)
- tissue blood flow modulation *see* blood flow modulation during radiofrequency ablation
- tissue electrical conductivity modulation 173
- tissue thermal conductivity modulation 173
- training, radiofrequency ablation 204–5
- transarterial chemoembolization (TACE) 6–8, 74–5, 87
 - colorectal metastases 82
 - contraindications 7–8, 86–7
 - efficacy 78
 - embolic materials 76–8
 - choice of chemotherapeutic agents 77
 - choice of embolic particles 76–7
 - choice of emulsion 77–8
 - embolization procedure 75–6
 - hepatocellular carcinoma therapy 6–8, 78–80
 - role as neoadjuvant therapy 80–1
 - with high intensity focused ultrasound 102
 - multimodality therapy 122
 - neuroendocrine tumor metastases 82–3
 - new developments 87
 - patient selection 86–7
 - optimum efficacy 86
 - optimum tolerability 86–7
 - post-procedural care 76
 - pre-treatment assessment 75
 - toxicity 83–5
 - postembolization syndrome 84
 - with radiofrequency ablation 175
- transforming growth factor alpha (TGF) 11
- transplantation *see* liver transplantation
- trisacryl gelatin spheres 77
- tumor lysis syndrome (cryoshock) 194
- ultrasonography (US) 47
 - contrast-enhanced (CEUS) 47, 48
 - cryoablation monitoring 189
 - cryoablation probe placement guidance 187
 - intraoperative (IOUS) 187–8
 - percutaneous ethanol injection follow-up 119
 - radiofrequency ablation guidance 153–7
 - see also* high-intensity focused ultrasound (HIFU) treatment
- unpaired arteries 35–7
- vascular endothelial growth factor (VEGF) 9
 - inhibition 9, 10
 - in colorectal cancer 2
- venous tumor vessels 37