Index

abdominal pain, investigation for, 147 abscesses, bowel, 145, 147 acoustic noise, 16-17 acquisition time breast imaging, 32 magnetic resonance angiography (MRA), 49, 62 rectal imaging, 153 temporal resolution and, 17 ACTHomas, 97 adenocarcinoma liver metastasis, 2 pancreatic, 86-91, 94, 100, 107 prostatic, 186 adenoma adrenal, 112, 114-15, 116, 117 colorectal, 145-7 pancreatic, 100 adhesions, bowel, 142 adiabatic pulses, 44 adrenal gland imaging adenoma, 112, 114-15, 116, 117 adrenal incidentalomas, 111 adrenocortical carcinoma, 117-18 cysts, 120 ganglioneuroma, 120-1 hemorrhage, 120 metastases, 113, 117 myelolipoma, 113, 116, 119 optimized 3T protocol, 117 pheochromocytoma, 118-19 techniques, 111-17, 122 adrenal SI-to-spleen SI ratio (ASR), 113-14 adrenocortical carcinoma, 117-18 aneurysms aortic, 54, 56-60 renal artery, 55 angiography insulinoma detection, 96 magnetic resonance (MRA), See magnetic resonance angiography (MRA) angiomyolipoma, 167, 172 anorectal junction, 153 antiperistaltic agents, 141, 198 aortic aneurysm, 54, 56-60 aortitis, 58-60 dissection of, 58 magnetic resonance angiography

mirror artifact from, 82 normal, 54 apparent diffusion coefficient (ADC) values bowel imaging, 142 breast imaging, 31 liver imaging, 76-7 prostate imaging, 184, 186-8 appendicitis, 147 arterial spin labeling (ASL), 15, 23 artifacts, See also specific artifacts female pelvic imaging, 197 increase at 3T, 1, 10 ascites, 4, 8, 14, 135, 141 atherosclerosis, 53, 54, 55, 58, 60-1 autoimmune pancreatitis, 109 b-value, 185 B0 field inhomogeneity bowel imaging, 135 breast imaging, 29 liver imaging, 67-9 novel acquisition techniques, 13-14 overview at 3T, 6-7 susceptibility and, 4-5 B1 field inhomogeneity bowel imaging, 135 breast imaging, 27, 30 cardiac magnetic resonance (CMR) imaging, 35-6, 37 liver imaging, 69-70, 77 novel acquisition techniques, 14 overview at 3T, 7-8 balanced steady-state free precession (bSSFP) bowel imaging, 136, 142, 145, 148 cardiac magnetic resonance (CMR) imaging, 35, 36-9, 40 banding artifacts balanced steady-state free precession (bSSFP), 35, 37-8, 136, 142 bowel imaging, 136, 142 cardiac magnetic resonance (CMR) imaging, 35, 37-8 steady-state free precession (SSFP), 19-20 bandwidth adrenal imaging, 117 chemical shift increase counteraction, 5 kidney MR imaging, 166 magnetic resonance angiography (MRA), 49 magnetic resonance urography, 173 barium enema use, 134 fecal tagging use, 138 follow-through examinations, 134

biliary-enteric anastomoses, 127, 129

biopsy breast, 32 prostate, 178, 180, 189, 190-2 black hole artifact, 8 bladder cancer (urothelial carcinoma), 173, 176 blood oxygen level-dependent (BOLD) technique, 16 blooming, 4 blurring artifacts, 71, 166, 173, 175 bolus timing, magnetic resonance angiography (MRA), 51 bone metastases, 160 bowel gas, susceptibility artifacts, 170, 175 bowel imaging 1.5T versus 3T, 147-8 adhesions, 142 artifacts at 3T, 134-6, 137-8 colorectal polyps and colorectal cancer (CRC), 145-7, 147-8 currently unstudied indications, 147 historical developments in, 134 inflammatory bowel disease (IBD)/ Crohn's disease, 142-5, 147, 148 patient preparation, 136-40 recommended scan parameters, 141 sequences at 3T, 140-2 bowel motion artifact, 141, 198-9 brain tumors, gadolinium contrast effects, 2 breast imaging 1.5T and 3T protocols' comparison, 32 3T literature review, 28 addressing specific challenges of 3T, 28 - 31advanced functional MR imaging techniques, 31 advantages of 3T, 26 biopsy guidance, 32 clinical perspective, 31-2 clinical utility of, 26 summary, 32-3 breath-hold instructions bowel imaging, 140 compliance difficulties, 104, 106 capillary blush, 83, 104 carbon dioxide (CO₂), rectal insufflation, 137, 138, 139 carcinoid tumors, 98, 147 cardiac magnetic resonance (CMR) imaging cine sequences, 40 first pass perfusion, 41-2 myocardial delayed enhancement (MDE), 42-4 myocardial tagging, 40-1

(MRA), 49, 56-60



summary of 3T benefits, 44-6	contrast-enhanced imaging	dielectric pad, 8, 69, 70
technical considerations at 3T,	adrenal, 116, 118, 120	dielectric shading/standing wave artifac
34–40	bowel, 136–40, 143, 145	bowel imaging, 141
uses of, 34	cardiac magnetic resonance (CMR),	cardiac magnetic resonance (CMR)
celiac disease, 147	35, 41–3	imaging, 35–6
cervical cancer, 200	differences at 3T, 2, 15	liver imaging, 4, 69–70
chemical shift	dynamic, See dynamic contrast-	novel acquisition techniques, 14
adrenal gland imaging, 111–15,	enhanced magnetic resonance	overview at 3T, 7–8
119, 121	imaging (DCE-MRI)	diffusion tensor imaging (DTI), 187
bowel imaging, 138	female pelvic, 202	diffusion-weighted imaging (DWI)
cardiac magnetic resonance (CMR)	gadolinium-based contrast agents,	bowel, 135, 142
imaging, 35, 37, 38–9	See gadolinium-based contrast	breast, 26, 31
female pelvic imaging, 197, 200, 202	agents	colorectal cancer (CRC) whole-body
liver imaging, 68–9, 71–5	iron-containing contrast agents,	imaging, 159–61
magnetic resonance angiography	See iron-containing contrast agents	dephasing in, 13
(MRA), 49	kidney MR imaging, 165, 166,	female pelvic, 200, 202
magnetic resonance spectroscopy	169–70	liver, 75, 76–7
(MR spectroscopy), 12	liver, 71, 75, 78	overview of, 23
novel acquisition techniques, 12,	magnetic resonance (MR) urography,	prostate, 183–8, 190, 191
18–19	173, 174-6	renal, 165, 166, 168, 170
overview of effects at 3T, 5–6 renal imaging, 170–1	magnetic resonance angiography	urinary tract, 165
chemoradiation (CRT), rectal cancer,	(MRA), See magnetic resonance angiography (MRA)	digital rectal examination (DRE),
150, 157–9	magnetic resonance	prostate cancer screening, 178 diverticular disease, 147
cholangiocarcinoma, 3, 124, 126, 127–8	cholangiopancreatography	Dixon method, two-point, 115–16
cholecystitis, acute, 129	(MRCP), 125, 131	double duct sign, 130
choledochal cysts, 126	pancreas, See pancreas imaging	duct of Santorini, 86
cholelithiasis, 104, 106	rectal, 152, 156	duct of Wirsung, 86
choline levels	contrast-to-noise ratio (CNR)	duodenum, See also bowel imaging
breast tumors, 31	breast imaging, 28	pancreatic cancer invasion, 92
prostate cancer, 184, 188–9	cardiac magnetic resonance (CMR)	ulceration, 95
Churg-Strauss syndrome, 43	imaging, 40, 41, 42, 43–4	duty cycle, 9
cine imaging	liver imaging, 72	dynamic contrast-enhanced magnetic
bowel, 142, 143	magnetic resonance	resonance imaging (DCE-MRI)
cardiac, 40	cholangiopancreatography	adrenal, 118
circumferential resection margin (CRM),	(MRCP), 124	bowel, 148
rectal cancer, 156	T1 relaxation times and, 15	female pelvic, 200, 202
cirrhosis, 3, 72, 74, 76-7	creatine, 182, 184, 188-9	liver, 77
citrate, 182, 184, 188-9	creeping fat, 144	prostate, 183, 189-90
collision tumor, 117	Crohn's disease, 142-5, 147, 148	dynamic magnetic resonance
colorectal cancer (CRC)	CT (computed tomography) imaging	imaging
adrenal metastasis, 113	bowel, 134, 145, 146	contrast-enhanced, See dynamic
etiology of, 150	colorectal cancer (CRC) whole-body	contrast-enhanced magnetic
detection at 1.5T versus 3T, 147-8	imaging, 159-61	resonance imaging (DCE-MRI)
incidence of, 150	multi-detector row (MDCT), 111	pelvic floor dysfunction, 202-4
liver metastasis, 2, 78	pancreas, 90, 104, 107	dysplasia, 140
MR colonography, 145-7	urography, 176	
rectal cancer staging, 150, 155-7,	cystadenocarcinoma	echo planar imaging (EPI)
159, 161	mucinous, 100	bowel, 135
restaging rectal cancer after	serous, 99	liver, 67, 76–7
chemoradiation (CRT), 157-9	cystadenoma	prostate, 183–8, 191
total mesorectal excision (TME),	mucinous, 100	susceptibility artifacts, 4, 15
150–1, 156	serous, 103–4	echo time (TE)
treatment stratification in rectal	cysts	adrenal imaging, 114, 117, 121
cancer, 150-1	adrenal, 120	bowel imaging, 135, 138, 141
whole-body staging, 159–61	hemorrhagic, 167, 169	breast imaging, 32
colorectal polyps, 140, 145–8	liver, 97	chemical shift effects and, 5–6, 12
comb sign, 143	ovarian, 197	field inhomogeneity limitation, 7
common bile duct (CBD), 83, 84, 90,	renal, 165, 166, 168, 171	in- and opposed-phase differences at
107, 127	1 1 : 12	3T and 1.5T, 18–19
computer-aided detection (CAD)	dephasing, 13	kidney MR imaging, 166
post-processing programs, 32	desmoplasia, 155, 159	liver imaging, 67–9, 71, 73–4, 75

echo time (TE) (cont.)	rectal imaging, 151, 152	focal nodular hyperplasia (FNH), 76
magnetic resonance angiography	renal imaging, 168	functional magnetic resonance imaging
(MRA), 49	single-shot partial fourier T2, 19	(fMRI), See also specific technique
magnetic resonance urography,	three-dimensional acquisitions, 17	breast, 26, 31
173, 174	fat-water misregistration	magnetic resonance angiography
pancreas imaging, 83	balanced steady-state free precession	(MRA), 62
prostate imaging, 180	(bSSFP), 38–9	magnetic susceptibility, 5
rectal imaging, 153	fecal tagging, 138–40	prostate, 179, 184, 190, 191
echo train length (ETL)	female pelvic imaging	furosemide, 173, 174, 175
liver imaging, 67, 71	adnexal mass, 204	11 . 1 52 52 50
rectal imaging, 153	advantages and disadvantages of 3T,	gadobutrol, 52, 53, 58
echo-train spin-echo sequences	197–9	gadodiamide, 52
pancreas imaging, 83	gynecologic malignancy, 200–2	gadofosveset, 52, 58, 62
single-shot, See single-shot echo-train	pelvic floor dysfunction, 202–4	gadolinium-based contrast agents,
spin-echo EKG-gating, magnetic resonance	sequences for, 199–200 ferritin, 73	See also specific agents
		bowel imaging, 136
angiography (MRA), 62 endocrine tumors, 91–8	fibro fatty proliferation, 144	kidney MR imaging, 170
	fibroide utering 200	liver imaging, 72, 76, 77, 78
endoleaks, 58	fibroids, uterine, 200	magnetic resonance angiography
endometrial carcinoma, 200–2	fibromuscular dysplasia (FMD), 54, 55 fibrosis	(MRA), 53, 58, 62
endometriosis, 204		magnetic resonance urography, 176
endorectal coils, 21, 179–80, 188	after chemoradiation (CRT), 158–9	relaxation rates at 3T, 2, 15, 35
endorectal ultrasound (EUS), 159	bowel, 143	gadoteridol, 53
enteroclysis, 134, <i>See also</i> magnetic	liver, 76–7 nephrogenic systemic (NSF), 2, 52, 175	gadoxetic acid, 125
resonance enteroclysis		ganglioneuroma, 120–1
eosinophilic myocarditis, 43 European Crohn's and Colitis	pancreatic, 107, 109	gastrinomas, 92, 94–5
Organisation (ECCO), current	field inhomogeneity B0 field, See B0 field inhomogeneity	Gd-BOPTA, 52, 53, 58
guidelines, 143	B1 field, See B1 field inhomogeneity	Gd-DOTA, 53 Gd-DTPA, 52
guidennes, 143	field of view (FOV)	ghosting artifacts, 13
FAME (Fast acquisition multiecho), 141	adrenal imaging, 117	glucagon, 141, 180
fast low-angle shot (FLASH), 40,	bowel imaging, 134, 141	glucagonomas, 97
See also spoiled gradient echo	breast imaging, 32	gradient echo (GRE) imaging
fast spin echo (FSE)	magnetic resonance angiography	adrenal glands, See adrenal gland
bowel imaging, 135	(MRA), 49, 62	imaging
female pelvic imaging, 199	pancreas imaging, 83	bowel, 135, 144, 145
liver imaging, 71, 76	prostate imaging, 180	female pelvic, 200
rectal imaging, See rectal imaging	rectal imaging, 151, 152, 153	kidney MR imaging, 164, 166,
single-shot, See single-shot fast spin	FIESTA (fast imaging employing	168–9, 172
echo (SSFSE)	steady-state acquisition), 40, 135,	liver, 67, 71, 74, 75
fat	See also balanced steady-state free	MR urography, 173, 175
creeping, 144	precession (bSSFP)	multiecho, 74
macroscopic, 167	fistulae, bowel, 145, 147	overview of 2D T1-weighted,
fat-only (FO) images, 113, 115–16,	flip angle	18–19
120, 121	adrenal imaging, 115, 117	susceptibility artifacts, 4, 15, 67
at saturation, See also fat suppression	balanced steady-state free precession	GRAPPA, 49, 50-1
bowel imaging, 140, 141, 144, 145, 146	(bSSFP), 36–7, 38	, , , , ,
chemical shift effects and, 12	bowel imaging, 141	half-Fourier acquisition single-shot
magnetic resonance angiography	breast imaging, 32	turbo spin-echo (HASTE)
(MRA) developments, 62	cardiac magnetic resonance (CMR)	adrenal imaging, 117, 119
at suppression	imaging, 35, 36–7, 38, 44	benefits of 3T, 3
adrenal gland imaging, 119	kidney MR imaging, 166	magnetic resonance
bowel imaging, 141, 143, 144	liver imaging, 71, 73, 74, 75	cholangiopancreatography
chemical shift effects and, 5	magnetic resonance angiography	(MRCP), 124
female pelvic imaging, 197, 200,	(MRA), 49	pancreas imaging, 83
202, 204	magnetic resonance	prostate imaging, 180
kidney MR imaging, 165, 166, 167	urography, 173	half-Fourier RARE (rapid acquisition
liver imaging, 71-5, 76	pancreas imaging, 83	relaxation enhancement), 83
MR urography, 173, 174	prostate imaging, 180	hemangioma, 76
pancreas imaging, 82-3, See pancreas	specific absorption rate (SAR) and,	hematocrit effect, 167
imaging	9, 15	hematuria, 176
prostate imaging, 183	steady-state free precession (SSFP), 19	hemochromatosis, 24, 67, 73

hemorrhage	iterative decomposition of water and fat	macroscopic fat, 167
adrenal, 118, 120	with echo asymmetry and least-	magnetic resonance angiography (MRA)
pancreatic, 104, 107	squares estimation (IDEAL)	aorta and iliac vessels' imaging, 56–60
post-prostate biopsy, 180, 189	method, 74	benefits of 3T, 21, 24, 47–9
hemorrhagic cysts, 167, 169		contrast agents for abdominal, 51–3
hemorrhagic necrotizing	jejunum, See also bowel imaging	contrast-to-noise ratio (CNR)
pancreatitis, 107	bile duct anastomosis, 127	increase in, 2
hemosiderin, 73, 169, 170	ulceration, 95	dephasing in, 13
hemosiderosis, 67	1.: J.,	future directions, 62
hepatic arteries, 61	kidney	imaging protocol for abdominal
hepatic steatosis, 108	chemical shift artifact, 5	contrast-enhanced (CE-MRA),
hepatitis B, 73	horseshoe, 165	49–51
hepatocellular carcinoma (HCC), 4, 74,	imaging, See renal imaging	mesenteric arteries, 60–2
76, 77	magnetic susceptibility artifact, 7	non-contrast-enhanced
hydronephrosis, 165	multilocular cystic nephroma, 167	(NCE-MRA), 53–4
hyperechoes, 71	organ transplantation, 55	renal artery imaging, 54–6, 62
hyperplasia, pancreatic, 100	renal arteries, <i>See</i> renal arteries	uses of abdominal/pelvic, 47
hypertrophic cardiomyopathy	renal cell carcinoma, 167, 168, 169	magnetic resonance
(HCM), 41	kinetic curves, breast imaging, 32	cholangiopancreatography
ileal joinnization 147	Larmor fraguency 5 12 25	(MRCP)
ileal jejunization, 147	Larmor frequency, 5, 12, 35	3T and 1.5T comparison, 124–5
ileocolonoscopy, 143	LAVA (liver acquisition with volume	acute cholecystitis, 129
imaging volume, 9, 48	acceleration), 58, 59, 61, 72	advantages over other imaging
implanted medical devices, safety issues, 9	lightbulb sign, 118 lipid fraction, quantification of, 18	techniques, 123
India ink artifact	liver imaging	anatomical variant and congenital
	applications in focal and diffuse liver	anomaly, 125–6
balanced steady-state free precession	disease, 75–7	cholangiocarcinoma, 127–8 choledocolithiasis, 126–7
(bSSFP), 38–9 cardiac magnetic resonance (CMR)	cirrhosis, 3, 72, 74, 76–7	intraductal papillary mucinous
imaging, 38–9	cysts, 97	neoplasms (IPMNs), 101–3, 131–2
increased magnetic field strength	fibrosis, 76–7	normal pancreas, 84
and, 5	future directions, 77	overview at 3T, 20–1, 123–4
kidney MR imaging, 171, 172	hepatic steatosis, 108	pancreas divisum, 86
novel acquisition techniques, 18	hepatocellular carcinoma (HCC), 4,	pancreatic cancer, 130–1
insulinomas, 91–4, 95–7	74, 77	pancreatitis, 108, 109, 129–30
internal iliac artery, 153	iron deposition, 4, 24, 73, 74, 75	postoperative pancreaticobiliary tract
intersectional gap	LAVA (liver acquisition with volume	alterations, 129
adrenal imaging, 117	acceleration), 58, 59, 61, 72	primary sclerosing cholangitis
bowel imaging, 141	metastases, See liver metastases	(PSC), 129
liver imaging, 75	opportunities and challenges at 3T,	secretin-enhanced, 109
pancreas imaging, 83	67–71	techniques, 125
intraductal papillary mucinous	optimized protocol for, 75	uses of, 82, 83
neoplasms (IPMNs), 100–3, 131–2	organ transplantation, 130	magnetic resonance colonography,
intrahepatic bile duct, 124	sequence optimization at 3T, 71–5	137-40, 145-7
inversion recovery	susceptibility-weighted imaging	magnetic resonance colonoscopy, 143
phase-sensitive (PSIR), 43	(SWI), 23–4	magnetic resonance elastography
preparatory pulses, 1	T1 relaxation times, 2	(MRE), 24
spectral attenuated (SPAIR), 19–20	liver metastases	magnetic resonance enteroclysis,
spoiled gradient recalled acquisition	1.5T and 3T, imaging differences, 2, 4	136–7, 143
in the steady state (IR-SPGR)	adrenocortical carcinoma, 118	magnetic resonance enterography,
method, 43	colorectal cancer (CRC), 2, 78, 159, 160	136–7, 142, 143
inversion time (TI), 43–4	ovarian cancer, 202	magnetic resonance spectroscopic
iodinated contrast agent, fecal tagging,	pancreatic cystic neoplasms, 97	imaging (MRSI), prostate, 181,
138–40	pancreatic endocrine tumors, 96, 97, 98	188–9, 190
iron	lung imaging, 21, 160	magnetic resonance spectroscopy
fat-only (FO) images in presence	lymph nodes	(MR spectroscopy)
of, 116	inflammatory bowel disease (IBD)	3T advantages, 21
liver storage, 4, 24, 73, 74, 75	imaging, 145	breast, 26, 31
iron-containing contrast agents, 5, 67,	pancreatic cancer metastases, 90–1	chemical shift effects, 5, 12
76, 157, 175	rectal cancer staging, 156–7, 159, 161	female pelvic imaging, 197, 202
islet cell tumors, 91–8	whole-body imaging, 160, 161	liver imaging, 68, 75
isotropic voxels, 47, 55	lymphoma, bowel, 147	spatial resolution increase in, 17

Index

magnetic resonance tagging, 40–1	off-resonance contrast angiography (ORCA), 62	precession/Larmor frequency, 5, 12, 35
magnetic resonance urography, 165, 172–7	organ transplantation, 55, 130 Ormond's disease, 58	pregnancy, MR urography in, 174 primary biliary cirrhosis, 109
magnetization preparation pulses, 1 mannitol, 136	ovaries, <i>See also</i> female pelvic imaging adnexal mass, 204	primary sclerosing cholangitis (PSC), 109, 129
Marfan's syndrome, 57	cysts, 197	PROPELLER (periodically rotated
matrix	ovarian cancer, 202	overlapping parallel lines with
adrenal imaging, 117	······································	enhanced reconstruction), 77
bowel imaging, 141	pancreas imaging	prostate cancer
breast imaging, 32	adenocarcinoma, 86–91, 94, 100, 107	biopsy guidance, 190-2
liver imaging, 75	cystic neoplasms, 98-104	current treatment options, 179
magnetic resonance angiography	endocrine tumors, 91-8	imaging of, See prostate imaging
(MRA), 49	imaging parameters, 83	incidence rates, 178
pancreas imaging, 83	intraductal papillary mucinous	screening and diagnosis, 178
prostate imaging, 180	neoplasms (IPMNs), 131-2	prostate imaging
rectal imaging, 153	normal pancreas findings, 83	advantages of magnetic resonance
mesenteric ischemia, 60-1	pancreas divisum, 83-6	imaging, 179
mesenteric vessels, 49, 53, 59,	pancreatic cancer, 130–1	background information on prostate
60–2, 153	pancreatitis, 88–90, 104–9, 129–30	cancer, 178–9
mesorectal fascia (MRF), 152, 153,	technique and advantages at 3T, 82–3	benefits of 3T, 18, 21
155, 156	parallel imaging (PI)	biopsy guidance, 190–2
mesorectum, 153 total mesorectal excision (TME),	breast, 29, 32 cardiac, 39–40	diffusion-weighted (DWI), 183–8, 190, 191
150–1, 156	female pelvic, 197	dynamic contrast-enhanced MR
metastatic disease	kidney MR imaging, 164, 166	imaging (DCE-MRI), 189–90
adrenal gland, 113, 117	liver imaging, 67, 70, 71, 77	endorectal coil use, 21, 179–80, 188
bone, 160	magnetic resonance angiography	magnetic resonance spectroscopic
liver, See liver metastases	(MRA), 49, 50–1, 60, 62	imaging (MRSI), 181, 188–9, 190
lung, 160	magnetic resonance urography, 173	morphologic, 180–1
lymph nodes, 90-1	novel acquisition techniques, 16	T2-weighted, 180–3, 190, 191
whole-body imaging, 159-61	prostate, 187	transrectal ultrasonography (TRUS),
microcystic adenoma, 103-4	parallel RF transmission, 30	178, 190–1
mirror artifact, pancreas imaging,	pediatric imaging, 21	prostate-specific antigen (PSA), 178
82	pelvic floor dysfunction, 202-4	prostatic hyperplasia, 178
motion artifacts	pelvic imaging	prostatitis, 178
bowel imaging, 141	female, See female pelvic imaging	pseudocysts, pancreatic, 105-7
female pelvic imaging, 198-9	magnetic resonance angiography	pulmonary emboli, 21
magnetic resonance angiography	(MRA), See magnetic resonance	It C (DE) d
(MRA), 47	angiography (MRA)	radiofrequency (RF) coils
prostate imaging, 179, 180	rectum, 151–3	breast, 28, 32
mucinous cystic neoplasm, 100	perinephric fluid, 171	liver imaging, 70
multi-detector row computed	peristalsis	prostate imaging, 21, 179–80, 186, 187, 188, 191
tomography (MDCT), 111 muscularis propria, 153, 154, 155,	antiperistaltic agents, 141, 198 bowel, 141, 180, 198	recent advances in, 8
159	ureteral, 175	radiofrequency (RF) cushion/dielectric
myelolipoma, 113, 116, 119	peritoneal reflection, 153, 154	pad, 8, 69, 70
myocardial delayed enhancement	peritoneal tumor metastases, 160	radiofrequency (RF) excitation
(MDE), 42–4	peritumoral stranding, 155	pulses, 70
myocardial tagging, 40-1	Peutz-Jeghers syndrome, 147	radiofrequency (RF) heating, specific
7 30 0	phase cancellation artifact, See India ink	absorption rate (SAR) and, 14-15
N-butyl scopolamine bromide, 141	artifact	radiofrequency (RF) transmission,
necrosis	pheochromocytoma, 118-19	parallel, 30
adrenal gland, 118	polyamine, 188–9	radiofrequency (RF) wavelength, B1 field
pancreatic, 97, 104-7	polyethylene glycol (PEG) electrolyte, 138	inhomogeneity and, 14
nephrogenic systemic fibrosis (NSF), 2,	polyps, colorectal, 140, 145-8	radiotherapy
52, 175	portal vein, 90	chemoradiation (CRT), 150, 157-9
nephroma, 167	positron emission tomography (PET)	rectal cancer, 150
nonalcoholic steatohepatitis	adrenal gland imaging, 111	rapid acquisition relaxation
(NASH), 74	colorectal cancer (CRC) whole-body	enhancement (RARE), 124
NSA (number of signal averages),	imaging, 159–61	rectal cancer, See colorectal cancer

post-processing filters, 70

141, 153

(CRC), rectal imaging



rectal imaging	serous cystadenoma, 103-4	spasmolytic agents, 151, 180
3T protocol, 151–2	shading artifacts, renal imaging, 171	spatial resolution
anatomy, 153–5	shimming	breast imaging, 28, 31-2
background to, 150-1	balanced steady-state free precession	cardiac magnetic resonance (CMR)
endorectal ultrasound (EUS), 159	(bSSFP) imaging, 38	imaging, 43-4
image quality, 153	bowel imaging, 135	female pelvic imaging, 197
recommendations, 161	breast imaging, 29	kidney MR imaging, 165-6
rectal cancer restaging after	cardiac magnetic resonance (CMR)	magnetic resonance angiography
chemoradiation (CRT), 157-9	imaging, 38	(MRA), 47, 49, 50
rectal insufflation, 137-8, 139	liver imaging, 67	novel acquisition techniques, 17
rectal vessels, 153	SI index (SII), 113-14, 115	specific absorption rate (SAR)
rectosigmoid junction, 153	signal intensity-time curves, 2, 42, 44	bowel imaging, 135, 141
renal arteries	signal-to-noise ratio (SNR)	breast imaging, 28-9
aneurysm, 55	balanced steady-state free precession	cardiac magnetic resonance (CMR)
magnetic resonance angiography	(bSSFP), 40	imaging, 35, 36
(MRA), 47, 54–6, 62	bandwidth increase and, 5	female pelvic imaging, 197
renal artery stenosis (RAS), 54-6, 62	bowel imaging, 141	liver imaging, 70-1
renal cell carcinoma, 167, 168, 169-70	breast imaging, 28	magnetic resonance angiography
renal imaging	cardiac magnetic resonance (CMR)	(MRA), 51
kidney MR imaging, 164–72	imaging, 34, 39-40, 41, 42, 43-4	novel acquisition techniques, 13, 14-15
MR urography, 172-7	diffusion-weighted imaging	overview at 3T, 8-9
renal arteries, See renal arteries	(DWI), 185	spectral attenuated inversion recovery
use of, 164	female pelvic imaging, 197	(SPAIR) technique, 19-20
renal transplant, 55	higher magnetic field strength and, 1,	spin echo (SE) imaging, 15, 135,
repetition time (TR)	2, 3, 12–13	See also fast spin echo (FSE); turbo
3T requirements, 1	liver imaging, 71, 73	spin echo (TSE)
adrenal imaging, 117	magnetic resonance spectroscopy	spoiled gradient echo
banding artifacts' reduction in bSSFP	(MRS) and increased, 21	cardiac magnetic resonance (CMR)
imaging, 37–8	parallel imaging, 39-40	imaging, 40
bowel imaging, 135, 141	spoiled gradient echo, 40	liver imaging, 78
breast imaging, 32	urinary tract imaging, 164, 177	pancreas imaging, 82, 83
kidney MR imaging, 166	simultaneous acquisition of spatial	standing wave artifact/dielectric shading
liver imaging, 71, 75	harmonics (SMASH), 16	bowel imaging, 141
magnetic resonance angiography	single-shot echo-train spin-echo	cardiac magnetic resonance (CMR)
(MRA), 49	kidney MR imaging, 166	imaging, 35–6
magnetic resonance urography, 173	lymph node metastases, 93	liver imaging, 4, 69–70
pancreas imaging, 83	MR urography, 173	novel acquisition techniques, 14
prostate imaging, 180	normal pancreas, 84	overview at 3T, 7–8
rectal imaging, 153	pancreatic adenocarcinoma,	steady-state free precession (SSFP),
respiratory gating, 62	88, 93	19–20, 53, 77
respiratory motion artifact, 4, 47	pancreatic cystic neoplasms, 101	balanced, See balanced steady-state
respiratory triggering, 19, 20, 124	pancreatic endocrine tumors,	free precession (bSSFP)
Riolan's anastomosis, 53	94, 96	stenosis
	pancreatitis, 104, 105, 106, 107	bowel, 143–4
safety considerations, 9	single-shot fast spin echo (SSFSE)	renal artery (RAS), 54-6, 62
sarcoma, uterine, 200	benefits of 3T, 3	stent, ureteral, 174
secretin-enhanced magnetic resonance	bowel imaging, 135, 141, 143,	superior mesenteric artery (SMA), 90,
cholangiopancreatography	145, 148	92, 109
(MRCP), 109	female pelvic imaging, 199	superior mesenteric vein (SMV), 90,
section thickness	liver imaging, 70, 74, 75, 76	92, 131
adrenal imaging, 117	magnetic resonance	superparamagnetic iron oxide (SPIO), 5,
bowel imaging, 141	cholangiopancreatography	67, 76
breast imaging, 32	(MRCP), 20–1	ultrasmall particles (USPIO), 76, 157
magnetic resonance	renal imaging, 167, 171, 172	susceptibility artifacts
cholangiopancreatography	single-shot partial Fourier T2, 19	bowel imaging, 135, 137
(MRCP), 125	siting issues, 9	breast imaging, 29, 32
pancreas imaging, 83, 125	Sjögren syndrome, 109	cardiac magnetic resonance (CMR)
prostate imaging, 180	sodium phosphate, 138	imaging, 35
rectal imaging, 151, 153	solid pseudopapillary tumor, 104–9	diffusion-weighted imaging (DWI),
sensitivity encoding (SENSE), 16, 50–1	somatostatinomas, 97	6-7, 22, 161
	sorbitol, 137	fat suppression breakdown, 20
serous cystadenocarcinoma, 99	SPACE sequence, 71, 199	female pelvic imaging, 198



Index

susceptibility artifacts (cont.)

kidney MR imaging, 170 liver imaging, 3, 68-9, 73, 76 magnetic resonance urography, 174 magnetic resonance cholangiopancreatography (MRCP), 21, 124 novel acquisition techniques, 15-16 overview at 3T, 2-5 prostate imaging, 180 three-dimensional T1-weighted GRE imaging, 18 susceptibility-weighted imaging (SWI), 16, 23-4, 67 T1 relaxation times bowel imaging, 134, 137 breast imaging, 27, 30 cardiac magnetic resonance (CMR) imaging, 34-5, 42 liver imaging, 71, 75 magnetic resonance angiography (MRA), 48 novel acquisition techniques, 15 overview at 3T, 1-2 prostate imaging, 180 renal imaging, 167-8 T2 relaxation times bowel imaging, 134 cardiac magnetic resonance (CMR) imaging, 34-5 liver imaging, 71 novel acquisition techniques, 15-16 overview at 3T, 2-3 prostate imaging, 180 T2* relaxation times, 3-5, 67, 68 Takayasu disease, 59, 60 temporal resolution, 17, 28 three-dimensional gradient echo (3D GRE) imaging adrenal, 114-16, 117, 121 bowel, 138, 139, 140, 141, 148 breast, 27, 29 kidney MR imaging, 167 liver, 72, 75 magnetic resonance angiography (MRA), 21 magnetic resonance urography, 165, 175

overview of T1-weighted, 17-18 pancreas, See pancreas imaging THRIVE (T1 high-resolution isotropic volume examination) aortic imaging, 58, 59, 61 bowel imaging, 141 liver imaging, 3-4 time of flight (TOF), liver imaging, 75 total mesorectal excision (TME), 150-1, 156 transrectal ultrasonography (TRUS), 178, 190-1TRAPS (smooth transitions between psuedo steady states), 71 TRICKS (time-resolved imaging of contrast-kinetics), 57 trueFISP (true fast imaging with steadystate free precession), 40, 135, 191, See also balanced steady-state free precession (bSFFP) tumor tissue, T1 relaxation times, 2 turbo spin echo (TSE) female pelvic imaging, 199 half-Fourier acquisition single-shot, See half-Fourier acquisition singleshot turbo spin echo (HASTE) liver imaging, 71 magnetic resonance cholangiopancreatography (MRCP), 20, 124, 127, 130 prostate imaging, 183 three-dimensional, 3, 20, 71, 124, 130, 199 two-point Dixon method, 112, 115-16 TWSIT (time-resolved MRA with stochastic interleaved trajectories), 57 ulceration, bowel, 145

ulceration, bowel, 145
ulcerative colitis, 142, 143
ultrasmall superparamagnetic particles
of iron oxide (USPIO), 76, 157
ultrasound
bowel, 134
endorectal (EUS), 159
transrectal ultrasonography (TRUS),
178, 190–1
ureter
imaging of, See urinary tract imaging
ureteral calculi, 175

ureteral stent, 174 urinary tract imaging congenital anomalies, 176 hematuria evaluation, 176 kidney MR imaging, 164-72 MR urography, 172-7 ureteral calculi, 175 urothelial carcinoma (bladder cancer), 165, 173, 176 use of, 164 urothelial carcinoma (bladder cancer), 165, 173, 176 uterus, See also female pelvic imaging adnexal mass, 204 bowel motion artifact, 198 cervical cancer, 200 endometrial carcinoma, 201 endometriosis, 204 fibroids and sarcoma differentiation, 200 normal, 198

vascular encasement, pancreatic cancer, VERSE (variable-rate selective excitation) sequences, 15, 71 VIBE (volumetric interpolated breath-hold examination) sequences bowel imaging, 141 liver imaging, 3-4, 58, 61, 72 magnetic resonance angiography (MRA), 59 pancreas imaging, 83 VIPomas, 97 von Hippel-Lindau disease, 98 voxel size breast imaging, 32 magnetic resonance angiography (MRA), 49

water excitation magnetization-prepared rapid acquisition gradient-echo (WE-MPRAGE), 104 water-only (WO) images, 115 water, bowel imaging use, 136, 138 whole-body imaging, 159–61

Zollinger-Ellison syndrome, 95