



Index

Note: Page numbers followed by *f* and *t* indicate figures and tables, respectively.

A

- Abscess
of cervical spine, 259–262
epidural
of cervical spine, 259–261
in pediatric patient, 341–342
thoracolumbar, 303, 305f
of foot/ankle, 216–217, 217f
on postgadolinium T1-weighted images, 90, 92f
of wrist/hand, 135–136
- Acetabular labrum
normal anatomy, 38, 40f, 42, 43f–44f, 147, 147f
pathology, 147–148, 148t
postoperative MRI evaluation, 151
tears, 147–151, 148f–149f
classification, 149, 149f
- Acetabulum
articular cartilage, normal, 147f
normal anatomy, 39f–40f, 42, 42f–43f
- Achilles tendinitis, 209–210
- Achilles tendinosis, 209–210, 210f
- Achilles tendon
disorders, 209–210, 209f
normal anatomy, 51f, 54, 55f
repair, postoperative MRI findings, 221–222, 222f
tear, 210, 210f
- AC joint. *See* Acromioclavicular joint
- ACL. *See* Anterior cruciate ligament
- Acquired immune deficiency syndrome, 262, 264, 303
- Acromioclavicular joint
abnormalities of, 105
capsular hypertrophy of, 105, 109f
morphology of, 103
Mumford procedure and, 114
normal anatomy, 17, 22
osteoarthritis, 109, 109f
- Acromion, 17, 19f–20f
morphology, types of, 103, 104f–105f
- Acute transverse myelopathy, in cervical spine, 262
- Adhesive capsulitis, of shoulder, 112–113, 113f
- Adolescent(s), spine, normal anatomy, 339–340
- AIDS. *See* Acquired immune deficiency syndrome
- Alcohol abuse, and osteonecrosis of knee, 191
- α angle, 157, 160f
- Amyloidosis, cervical spinal involvement in, 265
- Anatomy. *See* specific anatomical entity
- Anconeus (muscle), 23, 24f, 25, 25f, 26f, 27
- Aneurysm, 381
- Aneurysmal bone cyst, 388, 389f
spinal, 320t, 322–324, 323f
- Angiography. *See* MR angiography
- Angiolipoma, spinal, 327
- Ankle. *See also* Foot/ankle
sprain(s)
lateral, 203–204, 204f
medial, 204–205, 204f
syndesmotic (high), 205, 205f
- Ankylosing spondylitis
cervical spinal involvement, 235, 236f, 264
hip involvement, 160
- Annular ligament, of elbow, injury, 121
- Anterior cruciate ligament
avulsion, 174, 174f
cyclops lesion, 199, 199f
graft, tunnel placement, 199f
normal anatomy, 42, 44, 45f, 46, 47f–48f
reconstruction, MRI findings after, 198–199, 198f–199f
tears, 174–177, 174f–178f, 175t
- Anterior tibial tendon, disorders, 214, 215f
- Anterolateral ankle impingement, 215, 217f
- Arachnoiditis, 311, 312f
- Arthritis. *See also* Osteoarthritis
cervical spine involvement, 264–266
inflammatory, 362–363
psoriatic, cervical spinal involvement, 265
septic
of elbow, 124
of foot/ankle, 217
of shoulder, 112



Arthrography. *See* MR arthrography
Articular cartilage. *See also* Osteoarthritis
 components, 353
 of elbow, 362, 365f
 of feet, 362
 gradient-echo image, 80, 82f
 of hands, 362
 of hip, 359–360, 362f–364f
 imaging protocols for, 353–356
 of knee, 356–359, 356f, 359f–361f
 lesions
 classification, 356, 357t–358t
 grading, 356, 357t–358t
 MR signal characteristics, 353
 repair, postoperative imaging, 363–367,
 365f–367f
 specialized pulse sequences for, 353–355,
 354f–356f, 355t
 structure, 353
 zonal histology, 353, 354f
Artifact(s), 14–15
 magnetic materials causing, 425–426
 metallic substances and, 425–426
 susceptibility, gradient-echo imaging and, 14
Astrocytoma, low-grade, spinal, 331–332
Atlantoaxial dissociation, 238, 239f
Atlantooccipital dissociation, 236–237
Atlas (C1), 62, 62f
 trauma, 237–238
Axis (C2), 62, 62f
 trauma, 238, 238f

B

Baker (popliteal) cyst, 193, 194f, 374–375, 375f
Bankart
 lesion, 82f, 98–99, 98f, 100f, 103
 repair, 114
Biceps brachii muscle
 anchor, 101, 101f, 102, 113
 normal anatomy, 22–23
Biceps brachii tendon
 anchor, 100, 101f, 102, 103f
 distal, injury, 121, 122f
 long head of, 22
 abnormalities, 109–112, 111f–112f
 in bicipital groove, 17, 18f
 normal MRI appearance, 109, 110f
 normal anatomy, 18f
 short head of, 22
Biceps femoris muscle, strain, 185, 186f
Bicipital aponeurosis, 23
Biopsy, musculoskeletal, MRI-guided, 410f, 411
Bone scan(s), 419–422, 420f–421f

Bone tumors. *See also* specific tumor
 benign, 386–389
 clinical presentation, 385
 diagnosis, 385–386
 MRI and, 370
 of foot/ankle
 benign, 220
 malignant, 220
 malignant, 389–393
 MRI, advantages, 385–386
Brachialis muscle, 22–23
Buford complex, 100–101, 101f
Bursitis, 379–381, 382f

C

Caisson disease, and osteonecrosis of knee, 191
Calcaneus, stress fractures, 207, 207f
Calcific tendinitis, of shoulder, 113
Calcium pyrophosphate dihydrate deposition disease, cervical
 spinal involvement in, 266
Capitate, occult fracture, 131f
Carpal bones, distal, occult fractures, 130–131, 131f
Carpal instability, 135
Carpal tunnel syndrome, 138–139
Cartilage, articular. *See* Articular cartilage
Cauda equina syndrome, 296–297
Cellulitis, of foot/ankle, 216–217
Cerebrospinal fluid
 in spine, normal MRI appearance, 63
 on T2-weighted image, 77f, 78
Cervical spinal stenosis, 241f, 244f, 247, 250–253, 251t,
 251f–257f
 absolute, 252
 causes, 250, 251t, 253f
 central canal, 250–251, 253f
 degenerative upon congenital, 250, 252f
 foraminal, 250, 251f
 grading, 253, 257f
 mild, 253
 moderate, 253, 256f
 objective measures, 252–253
 relative, 252
 severe, 253, 257f
Cervical spine, 229–268
 abscess, 259–262
 acute transverse myelopathy, 262
 ankylosing spondylitis, 235, 236f
 annular tears, 244–245, 245f
 anterior longitudinal ligament, tears, 235
 arthritides, 264–266
 C2 nerve root, 67, 70f
 compression fracture, 232, 232f
 degenerative conditions, 242–255



- diffuse idiopathic skeletal hyperostosis, 235
discitis, 256–259, 261f
epidural abscess, 259–261
facet dislocations, 232–233, 233f–234f
flexion-compression injuries, 232–233, 232f
flexion-extension imaging, 242, 243f
imaging protocols for, 229
infectious conditions, 255–262, 261f
instability, characterization, 241–242, 242f
intervertebral discs
 avulsion from adjacent vertebral body, 235
 bulge, 245t, 246
 degenerative disc disease, 243–245, 244f
 displacement, 245–250, 246f
 and stenosis, 241f, 244f, 247
 extrusion, 245t, 246–247, 248f
 herniation, 235, 250, 251f
 horizontal rupture, 235, 235f
 injuries, 235
 pathology, 245, 245t
 protrusion, 245t, 246–247, 247f
 sequestration, 245t, 246
 “soft” versus “hard,” 247, 247f
intradural infections, 261–262
intrinsic inflammatory myelopathy, 262–264
leptomeningitis, 261–262
ligaments, normal anatomy, 67f–68f
in multiple sclerosis, 262, 263f
myelitis, 261–262
neural foramina, normal anatomy, 67
neural structures, normal anatomy, 67, 69f
normal anatomy, 66f, 67, 67f, 68, 68f, 70f–72f, 71–72
pediatric, normal anatomy, 339–340
posterior ligaments
 edema, 235
 injuries, 233, 235f, 242, 242f
prevertebral hematoma, 235
specialized pulse sequences for, 229
subacute necrotizing myelopathy, 263–264
subdural abscess, 261–262
trauma, 229–242
 axial load injuries in, 230, 236, 237f
 classification, 230–236, 231f
 evaluation, 230, 230t
 hyperextension injuries in, 230, 233–235
 hyperflexion injuries in, 230, 232–233, 232f
 imaging protocols for, 230
 mechanism of injury in, 230
 penetrating, 238–241
 region of injury in, 232
 spinal cord injury in, 235
 characterization, 241
tuberculous involvement, 258
tumors, 262
T2-weighted images, 77f, 81–84, 83f–85f
vertebral bodies. *See* Vertebral bodies
vertebral osteomyelitis, 256–259, 261f
Chamberlain’s line, 258t, 259f
Charcot neuroarthropathy, 218
Chemical-shift imaging, 403, 407f
Chiari malformations, 345
 with myelomeningocele, 344
 and occipitocervical stenosis, 253–254
 types, 254, 259f
Child(ren). *See also* Pediatric spine
 age 2 years, spine, 340, 341f
 age 10 years, spine, 340, 342f
 epidural abscess in, 341–342
 sedation protocols for, 338–339
 wrist/hand
 growth arrest, 131
 physeal bars, 131
 physeal injuries, 131, 131f
Chondroblastoma, 386, 387f
Chondrosarcoma, 393, 393f
 epidemiology, 385
 spinal, 325–326, 326f
Chordoma
 chondroid, 324
 spinal, 324–325, 325f
 typical, 324
Claustrophobia, 429
Clivus canal angle, 258t
Collagenous tissue, on T1-weighted images, 9, 10f
Computed tomography, 416–419, 417f–419f
Contrast-enhanced imaging, 14–15
 for MR arthrography, 397, 397t
 safety, 428–429
Conus medullaris, pediatric, 339f, 340–341, 341f
Conventional radiography, 414–416, 415f–416f
Coxa saltans (snapping hip syndrome), 153–154
Crowned dens sign, 266
Cryotherapy, MRI-guided, 411f, 412
Crystal deposition disorders, 126
CSF. *See* Cerebrospinal fluid
CT. *See* Computed tomography
Cubital tunnel syndrome, 125–126
Cyclops lesion, of anterior cruciate ligament, 199, 199f

D

- de Quervain tenosynovitis, 135, 136f
Diabetic myonecrosis, 376–377, 378f
Diagnosis, arrival at, correlation of imaging findings with patient history and examination in, 90–93, 92f
Diastematomyelia, 344
Differential diagnosis, correlation of imaging findings with patient history and examination for, 90–93, 92f
Diffuse idiopathic skeletal hyperostosis, cervical spine involvement in, 235



- Diffusion-weighted imaging, 403–404
Discitis, in pediatric patient, 341
Dupuytren contracture, of wrist/hand, 140, 141*f*
Dynamic (functional) imaging, 402–403, 403*f*–406*f*
- E**
- ECU. *See* Extensor carpi ulnaris
Elbow, 118–128. *See also* Forearm
 articular cartilage, 362, 365*f*
 compression neuropathies, 125–126, 125*f*–126*f*
 degenerative conditions, 122–123
 epiphysiolysis, 119, 119*f*
 imaging protocols for, 118
 infectious conditions, 123–124
 lateral and medial epicondylitis, 122–123, 124*f*
 LCL complex injury, 121, 121*f*
 ligamentous structures, 25*f*, 27–28
 loose bodies in, 119, 120*f*, 126
 medial collateral ligament, injury, 119–121, 120*f*
 MR arthrography image, 399*f*
 neural structures, 25*f*, 27*f*
 neurovascular structures, 27–28, 27*f*
 normal anatomy, 22–30, 24*f*, 28*f*–29*f*
 occult fractures, 118–119
 osseous contusion, 118–119, 119*f*
 septic arthritis, 124
 soft-tissue masses of, 126–127, 126*f*
 specialized pulse sequences for, 118
 synovial disorders, 126
 tendons, 22–23, 24*f*–27*f*, 27–28
 trauma, 118–122
Enchondroma, 387, 388*f*
Eosinophilic granuloma, spinal, 320*t*, 324, 324*f*
Ependymoma, spinal, 331–332, 333*f*–334*f*
Epidural lipomatosis, 300–301, 301*f*
Epithelioid sarcoma, 385
Ewing sarcoma, 390–393, 392*f*
 epidemiology, 385
 spinal, 326–327
Examination, physical, findings in, correlation with imaging findings, 90–93
Extensor carpi ulnaris, 23, 25, 25*f*
Extremity scanners, 400–401, 402*f*
Extrinsic carpal ligaments, injury, 132–133, 133*f*
- Femoral neck fracture, nondisplaced
 on short tau inversion recovery image, 79, 79*f*
 on T1-weighted image, 79, 79*f*, 86
Femoroacetabular impingement, 156–157, 157*f*–160*f*
FHL tendon. *See* Flexor hallucis longus tendon
Fibrous dysplasia of bone, 389, 390*f*
Fingers, muscles and ligaments, 33, 34*f*
Flexor hallucis longus tendon
 partial tear, 214–215, 216*f*
 tenosynovitis, 214–215
Flip angle, 5, 6*f*, 8, 13
Fluid-attenuated inversion recovery, physics of, 8
Foot/ankle, 202–225
 abscess, 216–217, 217*f*
 arthrodesis, postoperative MRI findings, 222–223
 bone contusion, 203, 203*f*
 bone tumors
 benign, 220
 malignant, 220
 cellulitis, 216–217
 Charcot neuroarthropathy, 218
 degenerative conditions, 208–216
 ganglion cysts, 219, 219*f*
 hemangioma, 219
 imaging protocols for, 202
 infectious processes, 216–218
 ligament sprains, 203–205
 normal anatomy, 51*f*–61*f*, 52–60
 osteomyelitis, 217–218, 218*f*
 postoperative MRI findings in, 221–223
 susceptibility artifact in, 222*f*
 septic arthritis, 217
 specialized pulse sequences for, 202
 sprains. *See* Ankle, sprain(s)
 stress fractures, 206–208
 tendons
 disorders, 208–215
 repair, postoperative MRI findings, 221–222, 222*f*
 tears, recurrent/new, 222, 222*f*
 trauma, 203–208
 tumors, 219–220
Forearm. *See also* Elbow
 distal, muscles, 32–33
 muscle architecture, 23–25, 24*f*
 muscles, classification of
 by compartment, 24–25
 by location, 23–24
FSE imaging. *See* Fast spin echo imaging
- F**
- Fast spin echo imaging, 8–9
Fatigue fractures, in hip, 151
Fat pad disease (Hoffa disease), 187
Femoral head, osteonecrosis, 154–155, 155*f*
- G**
- Gadolinium contrast, 14–15, 14*f*
 for MR angiography, 410–411
 for MR arthrography, 397, 397*f*



- safety, 428–429
Ganglion cyst(s), 373–374, 374f
 in foot/ankle, 219, 219f
 in wrist/hand, 139–140, 142f
Ganglioneuroblastomas, intermediate-differentiated, spinal, 327
Ganglioneuroma, spinal, 327, 327f
Gaucher disease, and osteonecrosis of knee, 191
Giant cell tumor
 of bone, 388
 spinal, 320t, 322, 322f
 of tendon sheath
 of foot/ankle, 219–220
 of wrist/hand, 139–140, 141f
Glenohumeral instability, 97–100, 98f–100f
Glenohumeral osteoarthritis, 108–109, 108f
Glenoid, 17, 18f, 20f
Glenoid labrum
 inferior, 17–20, 20f
 normal anatomy, 17, 18f–20f, 20
 pathology, 100–103, 102f, 103f
 superior, 17–20, 20f
Glomus tumor, of wrist/hand, 140
Gout, cervical spinal involvement, 266
Gradient-echo images, 7–8, 8f, 9
 characteristics of, 9, 9t, 13–14
 recognition of, 80, 82f
 three-dimensional, 14
Greater trochanteric pain syndrome, 152–153

H
Hallux valgus, repair, postoperative MRI findings, 223
Hamartoma, of wrist/hand, 140
Hamstring strains, 154
Hand(s). *See Wrist/hand*
Hemangioblastoma, spinal, 332, 335f
Hemangioma, 372–373, 373f
 of foot/ankle, 219
T1- and T2-weighted images, 86–87, 91f
vertebral, 319–320, 320f, 320t
 of wrist/hand, 139–140
Hemangiopericytoma, spinal, 329–331
Hematoma, 375–376, 376f
 of thoracolumbar spine, 308–309, 311f
 on T1-weighted image, 10f
Herniated nucleus pulposus. *See under Lumbar spine*
High-resolution imaging, 400, 401f
Hip, 147–163
 abductors, 38
 tears, 153, 153f
 adductors, 38
 strains, 154
 articular cartilage, 359–360, 362f–364f
 articular surfaces, 37, 39f
 athletic, 147–154
 bone marrow abnormalities, 154–156
 degenerative conditions, 156–160
 extensors, 38
 external rotators, 38
 femoroacetabular impingement, 156–157, 157f–160
 flexors, 38
 greater trochanteric pain syndrome, 152–153
 idiopathic transient osteoporosis, 155–156, 156f
 imaging protocol for, 147
 inflammatory disorders, 160
 intraarticular pathology, zone classification, 149, 150f
 MR arthrography image, 398f
 muscles, 38, 39f–41f
 strains, 154, 154f
 normal anatomy, 37–42, 40f, 42f–44f
 osteoarthritis, 158
 pain in, differential diagnosis, 147–148, 148t
 specialized pulse sequences for, 147
 stress fractures, 151, 151f
 synovial disorders, 160–161, 160f–161f
 trauma, 147–154
 traumatic posterior subluxation/dislocation/lateral
 impaction, 151–152, 152f
 trochanteric bursitis, 152–153
History, patient, correlation with imaging findings, 90–93
Hoffa disease, 187
Humeral epicondyles, 24f–26f
Humeral head, 17, 18f
Humerus, 20, 20f
 capitellum, osteochondritis dissecans, 125, 125f
 greater and lesser tuberosity, 20f, 22

I

- Iliotibial band syndrome, 191
Implant(s), metallic. *See also Metallic object(s) or substances*
 MRI in presence of, 406–408, 409f
 in pediatric spine, 347f, 348
 safety profiles, 426–427
Infant(s)
 age 3 months, spine, 340
 full-term, spine, 340
Infraspinatus muscle and tendon, 22
Insufficiency fractures, in hip, 151
Intervention(s), MRI-guided, 411–412
Intervertebral discs. *See under Lumbar spine*
Intervertebral osteochondrosis, of lumbar spine, 277–278, 278f
Intraoperative MRI, 401
Inversion time, 8
ITB syndrome. *See Iliotibial band syndrome*

**J**

Jersey finger, 133
Joint fluid, 86, 90f
Juvenile rheumatoid arthritis, cervical spinal involvement in, 264

K

Kienböck disease, 136–137, 137f
Knee, 164–201. *See also* Anterior cruciate ligament; Posterior cruciate ligament
acute hemarthrosis, 164
adhesion formation in, 193
anterior interval
 definition, 193
 scarring in, 193
arcuate complex, injuries, 181, 181f
articular cartilage, 356–359, 356f, 359f–361f
Baker (popliteal) cyst, 193, 194f, 374–375, 375f
bursitis, 190–191, 190f–191f
collateral ligaments
 normal anatomy, 44, 48f
 tears, 179–180, 179f–180f, 181t
degenerative joint disease, 193
degenerative (nonacute) pathology, 187–195
dislocation, 182–183, 182f
extensor mechanism
 degenerative (nonacute) pathology, 187, 188f
 normal anatomy, 52
 traumatic injuries, 183–185
gradient-echo image, 82f
Hoffa disease (fat pad disease), 187
imaging protocols for, 164
infectious conditions, 193–194
injuries, “terrible triad,” 180
loose bodies in, 185–187, 186f
meniscocapsular separation, 166t
meniscus/menisci
 allograft replacement, MRI findings after, 194–195, 198f
 degenerative, 193
 discoid, 188, 189f
 normal anatomy, 42, 50–52, 51f
 postoperative MRI findings, 194–195, 197f
 repair, MRI findings after, 194–195, 197f
 tears, 165–172
 bucket handle, 166t, 170f–172f, 171
 complex, 166t, 172
 displaced, 170f–173f, 171
 grading, 164t, 165–167, 165f
 horizontal, 165f–167f, 166t, 167
 morphologies, 166, 166t
 MRI characteristics, 165–166, 166t
 types, 164t, 165, 165f

vertical longitudinal, 166t, 169–171, 170f
vertical radial, 166t, 167–169, 168f–169f
muscle strain at, 185, 186f
neurovascular structures, normal anatomy, 50f, 52
normal anatomy, 42–44, 45f–50f, 46–52
Osgood-Schlatter disease, 188, 188f
osteochondrosis(es), 188, 188f
osteomyelitis, 193–194
osteonecrosis, 191–192, 192f, 192t
osteophytes, 193
partial meniscectomy, MRI findings after, 194–195, 195f–196f
patellar dislocation, 183–184, 183f–184f
patellar tendinitis, 187, 188f
patellar tendon rupture, 184f, 185
plicae, 188–190, 189f–190f
posterolateral corner
 injuries, 180–181, 180f–181f
 normal anatomy, 44, 48f
 structures of, 180
posteroslateral corner
 injuries, 181–182, 181f
 normal anatomy, 44, 48f
 structures of, 181
postoperative MRI findings in, 194–199
quadriceps tendon rupture, 185, 185f
septic effusion in, 193–194
Sindig-Larsen-Johansson disease, 188
specialized pulse sequences for, 164
stress fractures, 187, 187f
trauma, 164–187

L

Larmor equation, 3–5, 5f
Lateral ankle ligament, reconstruction, postoperative MRI findings, 222, 223f
Lateral collateral ligament
 of elbow
 injury (sprain, tear), 121, 121f
 normal anatomy, 28f, 29
 of knee
 in arcuate complex, 181, 191
 injury (sprain, tear), 179, 183
 normal anatomy, 44, 47f
Lateral collateral ligament complex, injury, 121, 121f
 injury, 121, 121f
 normal anatomy, 28, 29
Lateral ulnar collateral ligament, 27–29, 28f
 accessory, 121
 injury, 121, 121f
LCL. *See* Lateral collateral ligament
Leptomeningeal hemangioblastomatosis, 332
Lipoma, 371f, 372, 372f



- of elbow, 126–127, 126f
of wrist/hand, 140, 141f
- Lipomeningocele, 344
- Liposarcoma, 382–383, 383f
- Little Leaguer's elbow, 119, 119f
- Longitudinal relaxation, 5
- LUCL. *See* Lateral ulnar collateral ligament
- Lumbar spinal stenosis, 287f–289f, 293–296, 296f
anatomic changes causing, 295, 295f
degenerative upon congenital, 294–295, 294f
grading, 295–296
mild, 295–296
moderate, 296
objective measures, 295
severe, 296
- Lumbar spine, 269–315. *See also* Thoracolumbar spine
annular tears, 275f, 277, 277f, 282
herniated nucleus pulposus, 282–287, 286f–289f
central, 286, 286f–287f
far lateral, 286–287, 286f, 289f
foraminal, 286, 286f, 288f
lateral recess, 286, 286f
posterolateral, 286, 286f, 288f
imaging protocols for, 269
- intervertebral discs
anatomic zones on axial images, 286, 287f
bulge, 278, 278f, 279, 283, 284f
degenerative disc disease, 277–278, 280–281, 280f–283f
extrusion, 278, 278f, 279, 279f, 283–285, 285f
herniation, 277–278, 277f–278f. *See also* Herniated nucleus pulposus
broad-based, 278f, 279
contained *versus* uncontained, 280
focal, 278f, 279
generalized, 278, 278f
intravertebral, 280
localized, 278, 278f
recurrent, 307, 308f
migration, 279
normal, 277, 277f, 280
pathology
classification, 277–280
differentiating MRI features, 277, 277f
nomenclature for, 277–280
protrusion, 278f, 279, 279f, 283–286, 284f
central, 286, 286f–287f
far lateral, 286–287, 286f, 289f
foraminal, 286, 286f, 288f
lateral recess, 286, 286f
posterolateral, 286, 286f, 288f
sequestration, 278, 278f, 279
“soft” *versus* “hard” pathology, 287, 290f
- intervertebral osteochondrosis, 277–278, 278f, 280
- intradural-extramedullary mass, postgadolinium T1-weighted image, 81f
- normal anatomy, 73–74, 73f–75f
- pediatric, normal anatomy, 339, 339f
specialized pulse sequences for, 269
- spondylosis deformans, 277, 278f, 280
- trauma, 269–277
systematic approach for, 270, 270t
- vertebral bodies. *See* Vertebral bodies
- vertebral end plates, degenerative conditions, 280–289
- Lunate, idiopathic osteonecrosis, 136–137, 137f
- Lunotriquetral ligament, injury, 132, 133f
- Lymphoma(s)
epidemiology, 385
spinal, 327–328, 328f
- M**
- Magic angle phenomenon, 15, 52, 135, 167
- Magnetic dipole, 3, 3f
- Magnetic field(s)
metallic objects in, 426
physiologic effects, 425
static, physiologic effects, 425
time-varying, physiologic effects, 425
- Malignant fibrous histiocytoma, 385
epidemiology, 385
- McGregor's line, 258t, 259f
- MCL. *See* Medial collateral ligament
- McRae's line, 258t, 259f
- Medial collateral ligament
of elbow
injury (sprain, tear), 119–121, 120f
normal anatomy, 27, 28f
- of knee
injury (sprain, tear), 179–180, 179f–181f, 181t, 183
normal anatomy, 44, 45f–47f
- Median nerve
compression
in carpal tunnel, 138–139
at elbow, 125–126
at elbow, 26f, 27, 27f
- Meningioma, spinal, 328, 330f
- Meniscus. *See* Knee, meniscus/menisci
- Metacarpals, occult fractures, 131
- Metallic object(s) or substances, 425–427
artifact-producing, 425–426
external, 427
internal, 426–427. *See also* Implant(s), metallic
in magnetic fields, 426
superficial (skin surface), 427
- Metastatic disease
of bone, 385
spinal involvement, 316, 332–335
- Metatarsal stress fractures, 207–208, 208f
- MFH. *See* Malignant fibrous histiocytoma
- Microscopy, MR, 400, 401f



- Morton neuroma, 221, 221f
Motion artifact(s), 15
MR angiography, 408–411, 409f
 images, recognition of, 80, 82f
MR arthrography, 14–15, 397–398
 direct, 14–15, 397, 398f–399f
 contrast for, 397, 397t
 images, recognition of, 80, 82f
 indirect, 15, 397–398, 399f
MRI study(ies), review, steps for, 77
MR microscopy, 400, 401f
MR spectroscopy, 405–406, 408f
MR venography, 411
Multiple myeloma
 epidemiology, 385
 spinal involvement, 324, 325f
Multiple sclerosis, cervical spinal involvement, 262, 263f
Muscle. *See also* specific muscle
 tear(s), 378, 380f
 on T1-weighted images, 9, 10f
Myelitis, cervical spine, 261–262
Myelomeningocele, 344, 344f
Myonecrosis, diabetic and idiopathic, 376–377, 378f
Myositis ossificans, 376, 377f

N

- Navicular bone
 accessory, 211, 211f
 normal anatomy, 52f–54f, 53–54, 56f, 58, 59f, 60, 61f
 stress fractures, 207, 208f
Necrotizing fasciitis, of wrist/hand, 136
Net magnetization vector, 3–5, 4f, 7f
Neuroblastic tumors, spinal, 327
Neuroblastoma, spinal, 327
Neurofibroma, 377–378, 379f
 spinal, 329, 331f
Neutron(s), physical properties of, 3, 3f
Nonossifying fibroma, 389, 389f
Nuclear scintigraphy, 419–422, 420f–421f

O

- Occipitocervical junction
 anatomic relationships, 258t
 injury(ies), 236–238
 lines for use with MRI and computed tomography, 258t
Occipitocervical stenosis, 253–255
OCD. *See* Osteochondritis dissecans
Odontoid fracture(s), 238, 238f
Olecranon bursitis, septic and nonseptic, 124
Osgood-Schlatter disease, 188, 188f

- Os peroneum, 214, 215f
Osteoarthritis, 362–363
 Acromioclavicular joint, 109, 109f
 glenohumeral, 108–109, 108f
 of hip, 158
Osteoblastoma, 386
 spinal, 320t, 321, 321f
Osteochondritis dissecans
 of humeral capitellum, 125, 125f
 of talus, 205–206, 206f
Osteochondroma, 387, 388f
 spinal, 320t, 322, 323f
Osteogenic sarcoma, spinal, 326, 326f
Osteochondrosis(es)
 in intervertebral body, of cervical spine, 277–278, 278f, 280
 in knee, 188, 188f
Osteoid osteoma, 386
 spinal, 320, 320t, 321f
Osteomyelitis
 acute, 124
 differential diagnosis, 341, 342f
 of foot/ankle, 217–218, 218f
 of wrist/hand, 136
Osteonecrosis
 alcohol abuse and, 191
 of femoral head, 154–155, 155f
 in knee, 191–192, 192f, 192t
 of talus, 215–216, 217f
Osteosarcoma, 389–390, 392f
 epidemiology, 385
 spinal, 326, 326f
 subtypes, 390, 391f
Os trigonum, 214–215, 216f

P

- Painful os peroneum syndrome, 214
Pain management, MRI-guided interventions for, 412
Parallel imaging, 399–400
Pathology. *See* specific anatomical entity
Pavlov ratio, 252–253
PCL. *See* Posterior cruciate ligament
Pediatric spine. *See also* Child(ren); Spinal dysraphism
 and adult spine, differences between, 340
 conus medullaris, 339f, 340–341, 341f
 fractures, 342–343, 343f
 imaging protocols for, 338
 with implants, imaging in presence of, controversies with, 347f, 348
 infectious conditions, 341–342, 342f–343f
 MRI, controversies with, 347–348
 normal anatomy, 339–341, 339f
 specialized pulse sequences for, 338
 trauma, 342–343, 343f



Periosteal chondroma, 386–387
Peripheral nerve sheath tumor
 malignant, spinal, 329, 331*f*
 of wrist/hand, 140
Peroneal tendon, disorders, 211–214, 213*f*–215*f*
Peroneus quartus muscle, 213, 214*f*
Pes anserine bursitis, 190, 190*f*
Phalanges, of hand, occult fractures, 131
Physical examination, findings in, correlation with imaging
 findings, 90–93
Pigmented villonodular synovitis, 378–379, 381*f*
 elbow involvement in, 126
 foot/ankle involvement in, 219–220, 220*f*
 hip involvement in, 161, 161*f*
Piriformis syndrome, 154
Pixel(s), 7
Plantar fasciitis, 220–221, 221*f*
Plantar fasciotomy, postoperative MRI findings, 222–223
Plantar fibromatosis, 219, 220*f*
Plasmacytoma, solitary bone, 324
Positron emission tomography, 422, 422*f*
Posterior ankle impingement syndrome, 214–215
Posterior cruciate ligament
 graft, tunnel placement, 199
 laxity, grading, 179, 179*t*
 normal anatomy, 44, 45*f*, 48*f*, 49, 51*f*
 tears, 177–179, 178*f*
Posterior interosseous nerve, compression, 125–126, 126*f*
Posterior interosseous nerve syndrome, 125–126
Posterior longitudinal ligament, ossification, 247–250,
 249*f*–250*f*
Posterior tibial tendon
 dysfunction, 210–211, 211*f*
 tears, 211, 212*f*
Precessional frequency (ω_0), 3, 5*f*
Pregnancy, 427
Prepatellar bursitis, 191, 191*f*
Pronator syndrome, 125–126
Proton-density weighted images, 8–9
 characteristics of, 8–9, 9*t*, 11, 12*f*
 fast spin echo, 11, 12*f*
 with fat suppression, 11–12
 spin echo, 11, 12*f*
Pseudoaneurysm, 381, 382*f*
Pseudomeningocele, 309–310, 312*f*
Psoriatic arthritis, cervical spinal involvement in, 265
Pulse sequence(s), 7–8
 advantages and disadvantages, 9, 9*t*
 available for review, determination of, 77–80
 characteristics, 9, 9*t*
 conventional spin echo, 7–8, 7*f*, 9
 fast spin echo, 8–9
 fluid-sensitive, 9
 gradient-echo, 7–8, 8*f*
 novel (advanced), 403–406
 signal-to-noise ratio of, 9

specialized
 for articular cartilage, 353–355, 354*f*–356*f*, 355*t*
 for cervical spine, 229
 for elbow, 118
 evaluation of, 87–90
 for foot/ankle, 202
 for hip, 147
 for knee, 164
 for lumbar spine, 269
 for pediatric spine, 338
 for shoulder, 97
 for thoracic spine, 269
 for tumors of spine, 317
 for wrist/hand, 129
spin echo, T1-weighted
 characteristics of, 9–10, 10*f*–11*f*
standard, 8–9
PVNS. *See* Pigmented villonodular synovitis

R

RA. *See* Rheumatoid arthritis
Radial collateral ligament, 25*f*, 27, 29
 injury, 121
Radial head, fractures, 118–119
Radial nerve, 27*f*, 28
 compression, at elbow, 125–126
 at elbow, 25*f*–26*f*
Radial tunnel syndrome, 125–126
Radiography, conventional, 414–416, 415*f*–416*f*
Radius, distal, occult fractures, 130–131
Ranawat criterion, 258*t*, 259*f*
RCL. *See* Radial collateral ligament
Rectus femoris strain, 154, 154*f*
Rheumatoid arthritis, 126
 cervical spinal involvement in, 264, 265*f*
 hip involvement, 160
 and occipitocervical stenosis, 254–255, 260*f*
 wrist/hand involvement, 138, 138*f*–139*f*
Rice bodies, 135
Rotator cuff, 20, 20*f*, 22, 22*f*–23*f*
 tears, 106–108, 106*f*–108*f*
 MRI characteristics, 107, 107*t*

S

Safety, 425–429
Sarcoma
 epithelioid, 385
 Ewing, 390–393, 392*f*
 epidemiology, 385
 spinal, 326–327



- Sarcoma (*continued*)
osteogenic, spinal, 326, 326f
spinal, 325–327
synovial, 384, 384f
- Scaphoid
fracture/deformity, 129–130, 130f
occult fractures, 129–130, 130f
posttraumatic osteonecrosis, 137, 138f
- Scapholunate ligament, injury, 132, 133f
- Scheuermann's kyphosis, 288
- Schmorl's nodes, 287–289
- Schwannoma, spinal, 328–329, 330f
- Scoliosis, 298–300, 300f
MRI, controversies with, 347–348
- Sedation, for pediatric patient, 338–339
- Short tau inversion recovery
characteristics of, 9, 13, 13f
fat-suppressed images, evaluation, 87–90, 91f
images, recognition of, 78f–80f, 79
physics of, 8
- Shoulder, 97–117
adhesive capsulitis, 112–113, 113f
calcific tendinitis, 113
degenerative conditions, 103–112
fluid in, 86, 90f
imaging protocols for, 97
ligaments, 20, 20f
MR arthrography image, 82f, 398f
neurovascular structures, 20, 21f
normal anatomy, 17–22, 18f–23f
osseous structures, 17, 19f, 20
postoperative MRI findings in, 113–114
septic arthritis, 112
specialized pulse sequences for, 97
trauma, 97–103
vascular malformation, MR angiography, 82f
- Sickle cell disease, and osteonecrosis of knee, 191
- Signal intensity, factors affecting, 9, 9t
- Signal localization, 5–7
- Signal-to-noise ratio(s), 9
- Sinding-Larsen-Johansson disease, 188
- SLAP lesion(s). *See* Superior labrum anterior and posterior lesion(s)
- Snapping hip syndrome (coxa saltans), 153–154
- Soft-tissue tumors, 370–385
clinical presentation, 370–371
determinate lesions, 139, 371–381
diagnosis, MRI and, 370
at elbow, 126–127, 126f
history with, 370–371
indeterminate lesions, 139, 371
malignant, signs of, 371, 371f
physical examination with, 371
in wrist/hand, 139–140
benign, 139–140, 141f
- Spinal cord
atrophy, 251, 254f
- bacterial infection, 264
- cervical, 66f
compression, 241, 241f
injury, 235
characterization, 241
management, 241
- cystic degeneration, 251
- disease, acquired immune deficiency syndrome and, 264
- granulomatous disease, 264
- injury
in cervical spine trauma, 235, 241
in pediatric patient, 343
without radiographic abnormality, in pediatric patient, 343
- metabolic disease and, 264
- necrosis, 251
- normal MRI appearance, 64, 66f
- parasitic infestation, 264
- toxic disease and, 264
- viral infection, 264
- Spinal dysraphism, 343–347. *See also* Pediatric spine
classification, 343, 343t
definition, 343
occult, 343t, 344
- Spinal stability
assessment, 270, 272–277
definition, 272
posterior ligamentous complex and, 270f, 273, 273f
three-column concept, 272–273
- Spinal stenosis. *See* Cervical spinal stenosis; Lumbar spinal stenosis
- Spine. *See also* Cervical spine, Thoracic spine, Lumbar spine, Thoracolumbar spine
dynamic (functional) imaging, 402–403, 403f–406f
foramina, normal anatomy, 67
normal anatomy, 60–67
intervertebral discs, normal anatomy, 60–62
ligaments, normal anatomy, 64–67, 67f–68f
load-bearing imaging, 402–403, 403f–406f
nerve roots, normal anatomy, 67, 69f
pediatric. *See* Pediatric spine
positional imaging, 402–403
vertebral bodies, normal anatomy, 62–63, 62f–65f
- Spin-lattice relaxation, 5
- Spin-spin relaxation, 5
- Spondylolisthesis, 297–298
degenerative, 297, 299f
iatrogenic, 297–298
isthmic, 297, 298f
Meyerding classification, 297, 297f
pathologic, 297
traumatic, 276f, 297
- Spondyloptosis, 297
- SPONK. *See* Spontaneous osteonecrosis of knee
- Spontaneous osteonecrosis of knee, 191–192, 192t
- Sprain, ankle. *See* Ankle, sprain(s)



Stener lesion, 133
Steroid use, and osteonecrosis of knee, 191, 192t
STIR. *See* Short tau inversion recovery
Stress fractures
 calcaneal, 207, 207f
 of foot/ankle, 206–208
 in hip, 151, 151f
 in knee, 187, 187f
 metatarsal, 207–208, 208f
 navicular, 207, 208f
Subacromial bursitis, 105, 106f
Subacromial impingement syndrome, 103–106
Subacute necrotizing myelopathy, in cervical spine, 263–264
Subscapularis muscle and tendon, 17, 18f
Superior labrum anterior and posterior, lesions, 100–103, 101f–103f
Supraspinatus muscle and tendon, 17, 19f–20f, 22
Supraspinatus tendon
 tear, 86, 90f, 108, 108f
 tendinosis, 105, 106f
Susceptibility artifact(s), 15
 gradient-echo imaging and, 14
Synovial cyst, 374–375, 375f
Synovial osteochondromatosis, 126
 of hip, 160–161, 160f
Synovial sarcoma, 384, 384f
Syringohydromyelia, 344–345, 345f
Syrinx, 251, 344–345, 345f

T

Talus
 osteochondritis dissecans (osteochondral defect), 205–206, 206f
 osteonecrosis, 215–216, 217f
Target sign, 378, 379f
Tarsal tunnel surgery, postoperative MRI findings, 222–223
T2 decay, 5, 7–8
TE (echo time), 7, 7f–8f
Tendons, on T1-weighted images, 9, 10f
Tenosynovitis, de Quervain, 135, 136f
Teres minor muscle, 22
Tethered cord syndrome, 345–347, 346f
 MRI, controversies with, 348
TFCC. *See* Triangular fibrocartilage complex
Thoracic spine, 269–315. *See also* Thoracolumbar spine
 disc herniation, 287, 290f
 imaging protocols for, 269
 normal anatomy, 72–73
 osseous structures, 64f
 pediatric, normal anatomy, 340
 specialized pulse sequences for, 269
 trauma, 269–277
 systematic approach for, 270, 270t

vascular supply, 63, 65f
vertebral bodies, 62, 64f
Thoracolumbar Injury Classification and Severity Score, 270, 270f
Thoracolumbar spine, 269–315. *See also* Lumbar spine;
 Thoracic spine
 arachnoiditis, 311, 312f
 burst fracture, 271f, 274–275, 275f
 decompression without instrumentation/fusion,
 postoperative MRI findings, 307, 308f
 discitis, 302f, 303, 304f
 disc pathology, 275, 275f
 epidural abscess, 303, 305f
 epidural hematoma, 275–277
 epidural lipomatosis, 300–301, 301f
 facet arthropathy, 291–292, 291f–292f
 fracture morphology, 270, 270f–273f
 evaluation, 270–272, 271f–273f
 hematoma, 308–309, 311f
 high-intensity zone in, 275, 275f
 infectious conditions, 301–304
 instrumentation/fusion, postoperative MRI findings,
 307–308, 309f–310f
 neoplastic changes, 271–272, 272f–273f
 osteoporotic vertebral fractures, 270–271, 271f
 postoperative MRI findings, 304–312
 stability, assessment, 270, 272–277
 synovial cyst, 292–293, 293f
 trauma
 classification, 270
 neural compromise in, assessment, 273–274, 274f
 penetrating, 274, 274f
 role of MRI in, 270–277
 tuberculous involvement, 303–304, 306f
 vertebral osteomyelitis, 301–303, 302f
 vertebral translation or dislocation, 276f, 277
Thumb, ulnar collateral ligament injury, 133, 134f
Torg ratio, 252–253
TR (repetition time), 8
Transverse magnetization vector, 5
Transverse relaxation, 5
Trauma. *See* specific anatomic entity
T1 recovery, 5, 8
T2* relaxation, 5, 7–8
Triangular fibrocartilage complex, 33, 35f, 37
 components, 131
 injury, 131–132, 132f
 tears, 131–132, 132f
Triceps brachii muscle, 23
Triceps tendon
 distal, avulsion, 26f
 injury, 121–122, 123f
Trochanteric bursitis, 152–153
Truncation artifact(s), 15
T sign, 399f



Tuberculosis

- cervical spinal involvement, 258
 - osteomyelitis caused by, 341, 342f
 - thoracolumbar involvement, 303–304, 306f
- Tumors. *See also* Bone tumors; Soft-tissue tumors; specific tumor
- bone, 370, 385–393
 - foot/ankle, 219–220
 - soft-tissue, 370–385
 - spinal
 - anatomic locations, 316
 - cervical, 262
 - classification, 316
 - diagnosis, image evaluation for, 316
 - differential diagnosis, 341, 342f
 - by anatomic compartment, 316, 317t
 - imaging modalities for, 316
 - procedure for, 316
 - extradural, 316–328, 318f
 - differential diagnosis, 317t
 - metastatic disease as, 318–319, 319f
 - primary benign, 319–324, 320t
 - primary malignant, 324–327
 - imaging protocols for, 317
 - intradural-extramedullary, 316, 328–331, 329f
 - differential diagnosis, 317t
 - intramedullary, 316, 331–335, 332f
 - differential diagnosis, 317t
 - metastatic disease, 332–335
 - metastatic disease as, 316
 - MRI, advantages and disadvantages, 316–317
 - specialized pulse sequences for, 317
 - wrist/hand, 139–140, 141f

T1-weighted images

- characteristics of, 8–10, 9t, 10f–11f
- conventional spin echo, 9–10, 10f–11f
 - with fat suppression, 9–10, 11f
- evaluation, 79f, 86–87, 91f
- with fat suppression, 11–12, 13f
- postgadolinium, 9
 - evaluation, 90, 92f
 - recognition of, 80, 81f
- recognition of, 78–79

T2-weighted images

- of cervical spine, evaluation, 81–84, 83f–85f
- characteristics of, 8–9, 9t, 10, 11f
- evaluation, 81–86
 - pattern recognition, 84–86, 90f
- fast spin echo, 10, 11f–12f
- fat-suppressed
 - characteristics of, 9, 9t, 10, 11–12
 - evaluation, 87–90, 91f
 - recognition of, 79
- of knee, evaluation, 84, 86f–89f
- recognition of, 77f, 78–79, 78f
- spin echo, 10

U

- UCL. *See* Ulnar collateral ligament
- Ulna, distal, occult fractures, 130–131
- Ulnar collateral ligament, 25f, 27–28
 - of thumb, injury, 133, 134f
- Ulnar impaction syndrome, 134–135, 135f
- Ulnar nerve
 - compression
 - at elbow, 125–126, 125f
 - in Guyon's canal, 138–139, 140f
 - at elbow, 25f–26f, 27, 27f
- Ulnar tunnel syndrome, 138–139, 140f

V

- Vasculature, MR angiography, 80, 82f
- Vector(s), magnetization
 - longitudinal, 5, 6f
 - net, 3–5, 4f, 7f
 - transverse, 5, 6f
- Vertebral artery(ies), 70f
 - injury, 238, 240f
- Vertebral body(ies)
 - characteristics of, 81, 84, 84f
 - edema, 230, 230t, 261f
 - hemangioma, 87, 91f
 - height loss, 232
 - hyperextension injuries and, 233
 - integrity, 230, 230t
 - normal anatomy, 62–63, 62f–63f
 - spine infections and, 256, 258, 259
 - stenosis and, 247, 249f
 - subluxations, 264
- Vertebral compression fracture
 - on computed tomography, 80f
 - on short tau inversion recovery image, 79, 80f, 88, 91f
 - T2-weighted images, 88, 91f
- Voshell bursa, 190
- Voxel(s), 7

W

- Wackenheim's clivus baseline, 258t, 259f
- Welcher's basal angle, 258t
- Whiplash injury(ies), 235
- Wrist/hand, 129–143
 - compression neuropathies, 138–139, 139f–140f
 - degenerative conditions, 134–135
 - extrinsic carpal ligaments, injury, 132–133, 133f
 - ganglion cysts, 139–140, 142f
 - imaging protocols for, 129



infectious conditions, 135–136
interosseous ligaments, injury, 132, 133f
ligaments, 35, 36f
MR arthrography image, 399f
musculotendinous units, 30, 30f–31f, 33, 35, 35f–36f, 37, 38f–39f
neurovascular structures, 30, 30f, 32f
normal anatomy, 30–37, 30f–39f
occult fractures, 129–131, 130f–131f
osseous anatomy, 35, 36f–37f

rheumatoid arthritis, 138, 138f–139f
soft-tissue masses, 139–140
specialized pulse sequences for, 129
tendons, 33, 35f
 disorders, 135, 135f–137f
 injuries, 133–134
 overuse syndromes, 135, 137f
trauma, 129–134
tumors, 139–140, 141f
vasculature, 35, 36f

