

# INDEX

---

Note: Page numbers in *italics* indicate figures.  
Page numbers followed by a “t” indicate tables.

- A $\delta$  fibers, 53, 73, 75, 228, 289
- Abdominal surgery
  - IV-APAP for, 212-213, 218t
  - liposomal bupivacaine for, 257t
- Acetaminophen, 126, 209-223
  - action mechanism, 116t, 126, 209
  - administration, by set schedule, 277
  - adverse events, 217-220
  - cautions and contraindications, 217-220, 291, 317
  - combination with NSAIDs or coxib, 217
  - dosage, 116t, 126, 166t, 302t, 327t
    - IV-APAP, 211-212
    - oral and rectal, 210, 221
    - oxycodone/APAP, 166t
  - efficacy, 116t, 126, 209, 221, 290-291
    - IV-APAP, 212-216, 214-215, 218t-219t, 277
  - formulations
    - IV-APAP (Ofirmev), 17, 210-220
    - oral and rectal, 126, 209-210, 291
    - with oxycodone. See *Oxycodone-acetaminophen*.
  - indications for, 209, 210, 212, 212-213
    - ankle and foot surgeries, 369
    - breakthrough pain, 221
    - multimodal regimens, 221, 225, 277
    - for opioid-dependent/tolerant patients, 147
    - orthopedic surgery, 212, 216-217
    - outpatient orthopedic procedures, 380, 381-382
    - shoulder replacement, 317, 327t
    - spine and back surgeries, 336t, 338-339, 340-341
    - total knee or hip replacement, 290-296, 302t
    - trauma surgery, 393-394
  - IV-APAP (Ofirmev), 17, 147, 210-221, 338-339, 393-394
    - dosage, 211-212
    - efficacy, 212-216, 214-215, 218t-219t, 290
    - FDA approval, 211

Acetaminophen, IV-APAP (Ofirmev) (*continued*)

- postoperative administration, 129
- for shoulder replacement, 317
- in opioid formulations, 153
- pharmacokinetics, 212, 213, 220
- post hospital discharge, 129
- preventative/preincisional administration, 128, 129, 216, 217, 302t
- recommendations for, 111t, 112t, 116t, 221
- reduced opioid use with, 111t, 113, 216, 221, 277
- safety, 116t, 126, 290-291
  - in children, 210
  - hepatic toxicity, 217-220
- targets of, 118

Acute injury

- sensitization and, 72, 78-79, 87-89, 88
- triple response, 87

Acute pain, 58-59

- differences from chronic pain, 64t
- nociceptive pain, 57-58, 59t
- peripheral role in, 72, 90-91
- prostaglandins and, 70, 72
- stress responses to, 86t
- transition to chronic pain, 62, 63, 72, 82, 101, 104
- treatment algorithm for, 274

Adjuvant analgesics. See *Analgesic adjuvants*.

Adverse events. See also *Opioids; and other specific agents*

- constipation, 23, 109
- cost-related consequences of, 23-26, 27
- drowsiness/sedation, 23, 41
- itching, 23, 112
- nausea/vomiting, 23, 41, 109
- opioid-related, 23-26, 41-45, 41, 109-112, 141-144, 273t, 280-282
- postoperative ileus (POI), 23-24, 109
- with prescribed pain medications, 19
- respiratory, 23, 25, 41, 41
- urination, difficulty with, 23, 25, 41, 41, 112

Affordable Care Act (2010), 28-29

$\alpha$ -agonists, 116t, 124, 230-232

- action mechanism, 116t, 230
- coadministration with opioid agonist, 230

$\alpha$ -agonists (*continued*)

- dosage, 116t, 232
- for opioid-tolerant patients, 232
- targets of, 118

Amitriptyline (Elavil), 241

AMPA receptors, 73-74, 76, 94, 96

Amputation, preventing chronic pain due to, 130

Analgesia. See also *Pain management; Surgeries, specific*.

- adequate, 277-278
- continuous perioperative analgesia, 129-130, 130, 279
- current standards of dosing, 14-17
- gaps in, 46-49, 46t, 272-273, 274
- multimodal, 16-17, 109-136. See also *Multimodal analgesia*.
- need for improvement, 19-20
- opioid-mediated, 137-171
- patient-controlled (PCA), 15-16, 173-188
- postoperative, 403
- preventative (pre-incisional), 16, 128-130, 130, 262, 302t
- regimen with pre- and postoperative medications, 302t
- timing of (in advance of the pain stimulus), 16

Analgesic adjuvants, 225-246, 249-250, 278. See also *specific topics*.

$\alpha 2$ -agonists, 230-232

anticonvulsant analgesics, 235-237

corticosteroids, 239-241

local anesthetics, 226-230

muscle relaxants, 233-235

NMDA receptor antagonists (ketamine), 237-239

for total knee/hip arthroplasty, 292-293

tricyclic antidepressants, 241-242

Analgesic ceiling effect, 141

Analgesic options. See also *specific surgeries*.

for ankle and foot surgeries, 351-374

for hip arthroplasty, 285-314

morphine, neuraxial, 183-184, 185t

for knee arthroplasty, 285-314, 375-389

liposomal bupivacaine, 256t

for outpatient procedures, 375-389

for shoulder replacement, 316-324

for spine and back surgeries, 335-343

Analgesic options (*continued*)  
 for total joint replacement, 267-284  
 for total knee or hip arthroplasty, 285-314  
 for trauma surgery, 391-405

Analgesic window, 176

Anatomy of pain perception and pathways, 68-75, 71, 76-77, 80, 270

Anesthesia  
 continued analgesic delivery during, 129  
 regional, 249, 276t, 277-280, 278, 293-295. See also *Peripheral neural blockade*.  
 skill of anesthesiologist, 398  
 spinal, 343-344, 344, 396-397

Anesthesiologists, pain management recommendations for, 110t-112t

Ankle surgeries, 351-374  
 anatomy, 351-352, 353, 356-358  
 sensory innervation, 352, 352  
 pain generators, 352-359, 356  
 pain management options, 359-360, 360t-361t  
 analgesic adjuvants, 368  
 continuous nerve blocks, 361  
 intra-articular injection/local infiltration, 362-363  
 multimodal analgesia, 360t-361t, 361, 367-368, 369-370  
 opioid analgesics, 363-365, 367, 369  
 other approaches (cryotherapy, hypnosis, acupuncture), 361  
 regional anesthesia, 365-367, 366, 369

Antibiotics, perioperative, 289

Anticonvulsant analgesics, 126, 235-237, 236, 292-293  
 for shoulder replacement, 319-320, 327t

Antidepressants. See *Tricyclic antidepressants*.

APAP. See *Acetaminophen*.

Arthroscopic surgery, benefits of, 375, 376

Back surgery. See *Spine and back surgeries*.

Benzocaine, 231t

Benzodiazepines, 125, 234

Bleeding risk, with NSAIDs, 190, 192, 204t

Blood flow, alterations in, 87, 92-93

Brachial plexus blockade, 278, 320-321, 322, 325

Brainstem, 79, 81

Breakthrough pain, 137, 221, 274, 367

Bupivacaine (Marcaine). See also *Exparel*; *Local anesthetics*.  
 actions, 117t, 121, 227, 228  
 adverse effects, 230  
 benefits of, 227-229, 363  
 coadministration with Exparel, 252-253, 295-296, 383-384  
 coadministration with spinal morphine, 123  
 dosage, 117t, 229, 231t  
 efficacy and safety, 117t, 121, 229  
 Exparel (bupivacaine liposome injectable suspension), 117t, 120, 226-227, 247, 252-255, 362-363. See also *Exparel*.  
 indications for, 226-228  
 ankle and foot surgeries, 362-363, 365  
 periosteal pain from spinal surgery, 130  
 shoulder replacement (Exparel), 324  
 wound infiltration, 230-232  
 SABER-bupivacaine, 248, 258-259, 259  
 spinal administration, 278, 281

Buprenorphine (Subutex, BuTrans), 141, 164-165  
 dose response, 142

Butorphanol, dose response, 142

C-fibers, 53, 73, 75, 228

Calcitonin gene-related peptide (CGRP), 75

Caldolor. See *Ibuprofen, injectable*.

Cardiovascular morbidity, as result of poorly controlled pain, 85, 89

Cardiovascular risk  
 COX-2 inhibitors, 200, 204t  
 local anesthetics, 229-230

Carisoprodol (Soma), 233

Celebrex/celecoxibs. See *COX-2 inhibitors*.

Center for Medicare and Medicaid Services (CMS), Value-Based Purchasing mandates, 28

Central-acting analgesics, 125-126

Central nervous system (CNS) effects, 270  
 of opioids, 24-25, 41, 41

Central pain, 62

Central sensitization, 60, 72, 82, 93-95, 102  
development of chronic pain and, 75  
mediators of, 94, 96-97  
neuroanatomical plasticity, 75, 82  
preventing, 391-392  
Chloroprocaine, 231t  
Chronic pain, 21-22, 61-62, 101-105  
characteristics of, 62  
differences from acute pain, 64t  
incidence of, postsurgical, 102, 103t  
lack of adaptive process for, 82  
peripheral role in, 72  
risk factors for, 101, 101  
transition from acute pain to, 62, 63, 72, 75, 82, 101, 104  
Clonidine, 116t, 124, 230-232, 400  
dosage, 116t, 232  
epidural solution (Duraclon), 124  
IV, 230  
transdermal (Catapres patch), 124, 230  
Cocaine, 226  
Codeine, 138, 165, 167t, 304t, 336t  
Cognitive dysfunction, postoperative (POCD), 276-277  
Conduction, 120-122, 270  
Constipation, 23, 41, 109, 142  
Convalescent pain, 61, 101-105, 101  
Coronary artery insufficiency, 92  
Cortical perception, 71, 71, 125-126, 270  
Corticosteroids, 119, 239-241  
action mechanism, 239-240  
contraindications, 241  
postoperative administration, 129, 240  
preventative/preoperative administration, 128  
risk-benefit balance, 240-241  
Cortisol, 98  
Costs  
of care, with poorly controlled pain, 85  
of hospital stays/readmissions, 21, 22t, 27  
of opioid-related adverse events, 23-26, 27, 42, 43  
COX-1, 189, 191  
COX-2, 70, 72, 191

COX-2 inhibitors, 199-200  
action mechanisms, 116t, 190, 191, 199  
adverse effects and warnings, 199, 200, 204t  
agents  
celecoxib (Celebrex), 115, 119, 199-200, 291  
rofecoxib (Vioxx), 199, 201  
valdecoxib (Bextra), 199  
cautions and contraindications, 199, 200  
dosage, 116t, 200, 204t, 327t  
efficacy, 116t, 201-203, 291  
COX-2 selectivity, 193, 204t  
indications for, 111t, 112t  
ankle and foot surgeries, 368, 369  
outpatient orthopedic procedures, 381  
shoulder replacement, 319, 327t  
spine and back surgeries, 336t, 340  
total knee or hip replacement, 291-292, 293, 302t  
trauma surgery, 394  
in multimodal approach, 89, 111t, 116t, 225, 277  
post hospital discharge, 129  
preventative/preoperative administration, 129  
reduced opioid use with, 111t, 113, 202, 277  
safety, 116t, 199, 200, 204t  
targets of, 118  
underprescription of, 37  
Cryotherapy, 384  
Cyclobenzaprine (Flexeril), 233, 234  
Cytokines, 72, 87  
  
Deep vein thrombosis (DVT), 92-93, 186  
Demerol (meperidine), 151-152  
DepoDur, 123  
DepoNSAID, 119  
Dermatomes, 344, 344  
Descending inhibition, 71, 71, 80-82, 80, 124-125  
Dexamethasone, 116t, 240, 249  
addition to local anesthetics, 229, 365  
concerns about, 368  
intraoperative, 368, 369  
Dexmedetomidine, 116t, 124, 230, 232

Diazepam (Valium), 125, 234  
Diclofenac  
  oral, 204t, 340, 381  
  transdermal patch, 119, 189  
Diclofenac injectable (Dyloject), 189, 196-199, 204t  
  action mechanisms, 196, 199  
  adverse effects, 198, 199  
  dosage, 116t, 196-197, 204t  
  efficacy, 116t, 193, 196, 197-199  
    COX-2 selectivity, 193, 196, 204t  
  safety, 116t, 197-199, 204t  
  for total knee or hip replacement, 291-292  
Dilaudid. *See Hydromorphone.*  
Dolophine. *See Methadone.*  
Dorsal horn, 72, 73, 79, 80, 81  
  neurons in, 73-75, 74  
  targets for analgesia, 122-125  
Drowsiness/sedation, 23, 41  
Dual-acting analgesics, 117t, 155  
Duraclon, 124  
Dyloject. *See Diclofenac, injectable.*  
  
Edema, 87  
Elderly patients  
  adverse pathophysiologic effects after surgery, 86t  
  alternatives to PCA delivery, 47-48  
  cautions for, opioids, 146, 317  
  consequences of poorly controlled pain, 85, 86t  
  knee arthroplasty, 275-277  
  opioid adverse events, 42-44, 292  
  postoperative cognitive dysfunction (POCD), 276-277  
Emotional and cognitive impact of pain, 98-99  
Endorphins, 75  
Enkephalins (ENKs), 75, 122  
Epidural analgesia  
  adverse effects, 186  
  continuous epidural infusion, 123, 279  
  contraindications and cautions, 186, 293  
    anticoagulant formulas, 123, 186

Epidural analgesia (*continued*)  
  improved sleep and QOL with, 99  
  for knee surgery, 94  
  patient-controlled (PCEA), 183-186, 185t, 397  
Epinephrine, addition to local anesthetics, 229, 230, 254, 295, 396  
Excitatory amino acids (EAAs), 73, 94  
Exparel (bupivacaine liposome injectable suspension), 226-229,  
  247, 252-255. *See also Bupivacaine; Local anesthetics.*  
  action mechanism, 117t  
  applications and benefits, 227-229  
    codadministration with bupivacaine HCL, 252-253, 255, 295-296,  
      383-384  
    single-dose infiltration, 247, 252, 383  
  contraindications, 253  
DepoFoam drug delivery system, 227, 247, 253, 280  
dosage, 117t, 231t, 256t-257t  
  maximum, 280  
duration of activity, 120, 128, 228  
efficacy, 117t, 120, 254-255, 256t-257t  
FDA approval for, 226, 247, 252, 280, 362, 383  
indications for, 226-227, 278  
  ankle and foot surgeries, 362-363, 365  
  knee/hip arthroplasty, 295-296  
  outpatient orthopedic procedures, 383-384  
  perioperative pain management, total joint replacement, 280-281  
  shoulder replacement, 324  
  single-dose infiltration, 247, 252  
  specific surgeries, 256t-257t  
IV-PCA in addition to, 178  
pharmacokinetics, 253-254  
postoperative administration, 129  
preventative/preoperative administration, 128  
safety, 117t, 120, 254-255, 363  
  
Fast-track postsurgical program, 334  
Femoral nerve blockade, 293-294, 306t, 366, 397-398  
Fentanyl (Sublimaze), 150-151, 154t  
  dose response, 142  
  epidural analgesia and PCEA, 184, 185t

- Fentanyl (Sublimaze) (*continued*)
- indications for
    - ankle and foot surgeries, 364-365
    - spine and back surgeries, 337t, 339, 342t
  - intrathecal, 122
  - opioid-induced delirium and, 24-25
  - oral (Oralet), 167t
  - PCA: fentanyl iontophoretic transdermal system (IONSYS), 16,
    - 173, 178-179, 179, 318t, 342t, 343, 364-365, 400
    - advantages vs disadvantages of, 182t
    - perioperative, 339
  - Foot surgeries, 351-374
    - anatomy, 351-352, 353, 356-358
      - sensory innervation, 352, 352
    - intraoperative tourniquets, 355
    - pain generators, 352-359, 356
    - pain management options, 359-360, 360t-361t
      - analgesic adjuvants, 368
      - continuous nerve blocks, 361
      - Exparel, 365
      - intra-articular injection/local infiltration (local anesthetics),
        - 362-363, 365
      - multimodal analgesia, 360t-361t, 361, 367-368, 369-370
      - opioid analgesics, 363-365, 367, 369
      - other approaches (cryotherapy, hypnosis, acupuncture), 361
      - regional anesthesia, 365-367, 366, 369
  - Gabapentinoids, 126, 235-237, 249-250, 384
    - action mechanism, 117t, 126, 235
    - dosage, 117t, 235, 237, 275, 302t, 327t
    - efficacy, and safety, 117t, 235-237, 236, 293
    - indications for
      - ankle and foot surgeries, 368
      - shoulder replacement, 319-320, 327t
      - spine and back surgeries, 336t, 338
      - total joint replacement, 274-275
      - total knee/hip arthroplasty, 292-293, 302t
      - trauma surgery, 395
    - preoperative loading, 274-275
  - Gate control theory, 55, 56
  - Glutamate, 73, 76-77, 94, 96
  - HCAPHS survey, 28
  - Heparins, low molecular weight (LMWHs), 123, 186,
    - 397, 398t
  - Hepatic toxicity, of acetaminophen, 217-220
  - Hip arthroplasty, 267-284. See also *Joint replacement; Knee arthroplasty*.
    - analgesic options, 267-284, 278, 285-314
    - acetaminophen, 290-296
      - Exparel (liposomal bupivacaine), 295-296
      - Mayo Clinic multimodal analgesic regimen, 300, 308t-309t
    - multimodal analgesia, 296-300, 301t
    - NSAIDs and COX-2 inhibitors, 291-292, 293
    - pregabalin, 293
      - regional nerve blocks, 293-295, 306t-307t
    - indications for, 286
    - morphine, neuraxial, 183-184, 185t
    - number performed annually, 286
    - older patients, 275-277
    - postoperative analgesia, 276t
    - postoperative pain experiences, 267
    - preoperative antibiotics, 298
    - spinal or intra-articular anesthesia, 279
    - total
      - analgesic options, 267-284, 278, 285-314
      - goals of pain management, 290
      - pain characteristics, 289-290
      - surgical approach, 286-287
      - wound infiltration techniques, 250-252
  - Hospital performance standards, 14, 26-30
  - Hospital stays
    - costs of opioid-related adverse events, 25-26, 27, 42, 43
    - length of (LOS)
      - with opioid-related adverse events, 42-44, 43
      - with poorly controlled postsurgical pain, 13, 21
      - reduced with multimodal analgesia, 279
    - performance standards, 26-30
    - readmissions, 13, 21
      - cost of, 21, 22t, 27
      - penalties for poor performers, 29
  - Hydrocodone, 129, 153, 157, 304t
    - with APAP (Vicodin, Lortab), 157, 166t, 210

- Hydromorphone (Dilaudid), 149-150, 154t  
 dose response, 142  
 epidural infusion and PCEA, 123, 184, 185t  
 indications for  
   ankle and foot surgeries, 364  
   shoulder replacement, 316  
   spine and back surgeries, 336t, 337, 337t, 339, 342t  
   trauma surgery, 395  
 oral, 153, 161, 167t, 304t, 318t  
 PCA, 173, 178, 318t, 342t
- Hyperalgesia, 60, 78-79, 391  
 defined, 78  
 opioid-induced (OIH), 129, 144-145  
 primary, 60, 72, 73, 78, 87-89  
 secondary, 60, 72, 78-79, 93-95  
   mediators of, 94, 96-97  
 sensations associated with, 78t  
 stimulus response alterations with, 88
- Ibuprofen injection (Caldolor), 115, 189, 193-196  
 action mechanisms, 116t, 193-194, 193  
 administration, by set schedule, 277  
 cautions, 196  
 dosing, 116t, 194, 204t, 336t, 340  
 efficacy, 116t, 192-196, 195, 201, 277  
   COX-2 selectivity, 193, 193, 204t  
   for outpatient orthopedic procedures, 381  
   for spine and back surgeries, 340  
   for total knee or hip arthroplasty, 291-292  
   vs IV ketorolac, 205  
 safety, 116t, 194-196, 204t
- Ibuprofen (oral), 204t
- Imipramine, 117t
- Immunosuppression, 402t
- Inflammatory chemicals/signaling, 70, 87, 94, 96
- Injury, stress response to, 86t, 95-98
- Intra-articular injections, 277-278, 279, 320, 362-363, 380, 396
- IONSYS (transdermal fentanyl system), 16, 173, 178-179, 179, 343, 364-365, 400
- Ischemia, perioperative, 92
- Itching, 23, 112, 142
- Joint replacement, total, 267-284  
 early rehabilitation, benefits of, 249  
 effects of poorly controlled surgical pain, 268-269, 268  
 goals of pain management, 269-271, 280  
   achieving, 271-277  
 multimodal pain management, 267-268, 271-280  
   algorithm for, 278  
   evolving, 277-280, 278  
   gabapentinoids, 274-275  
   local anesthetics (Exparel), 280  
   opioids, 272-273, 275  
   peripheral anesthesia and intra-articular injections, 277-278, 279  
 perioperative management, 271, 276t, 280  
 peripheral nerve blockade, 274  
 preemptive analgesia, 273-275, 276t  
 variance of analgesic techniques for, 281
- Ketamine, 123-124, 237-239  
 action mechanism, 116t, 123-124, 237-238  
 adverse effects, 239, 293  
 contraindications, 239  
 dosage, 116t, 124, 238, 238t, 341  
 efficacy, 247-249, 293  
 indications for  
   opioid-tolerant patients, 147, 238-239  
   spine and back surgeries, 341  
   total knee/hip arthroplasty, 292-293  
 postoperative administration, 129, 238t  
 targets of, 118
- Ketorolac (Toradol), 116t, 192-193, 291  
 bleeding risk with, 115, 192, 204t  
 in combination with nerve block, 295  
 dosing, 116t, 192-193, 204t, 327t, 336t  
   in multimodal regimes, 192  
 efficacy, 116t, 240  
   COX-2 inhibition, 192, 193  
 indications for  
   outpatient orthopedic procedures, 381  
   shoulder replacement, 319, 327t  
   spine and back surgeries, 336t, 337t, 340

Ketorolac (Toradol), indications for (*continued*)  
total knee/hip arthroplasty, 291, 302t  
trauma surgery, 395  
injectable/IV administered, 115, 116t, 192-193, 204t, 291  
intranasal formulation, 205  
safety, 116t, 204t  
warning for prophylactic analgesia, 192

Knee arthroplasty, 375, 376. See also *Joint replacement*.  
analgesic options for, 94, 121-122, 183-184, 290-314, 375-389  
acetaminophen, 290-296  
adjuvants, 292-293  
algorithm for, 278  
epidural anesthesia, 285  
Exparel (liposomal bupivacaine), 295-296  
gabapentin, 293  
IV-APAP, 212  
IV-PCA with morphine, 285  
ketamine, 293  
local anesthetic infiltration, 17, 121  
Mayo Clinic multimodal analgesic regimen, 300, 308t-309t  
multimodal analgesia, 296-300, 301t  
NSAIDs and COX-2 inhibitors, 291-292, 293  
opioids, 273, 274, 275, 292  
periarticular infiltration, 295  
perioperative pain management, 379-384  
pregabalin (Lyrica), 236, 293  
regional anesthesia/analgesia, 293-295, 306t-307t  
total joint replacement, 94, 121-122, 183-184, 267-284  
causes of pain, 376-379  
diagnostic  
causes of pain, 376-379  
visualizing compartments, 377, 378  
effort-dependent pain, regional blockade and epidural analgesia  
to reduce, 94  
morphine, neuraxial, 183-184, 185t  
number of surgeries (annually), 13  
older patients, 275-277  
postoperative analgesia, 276t  
postoperative pain experienced, 267  
preoperative antibiotics, 298

Knee arthroplasty (*continued*)  
prolonged/persistent pain following, 102  
spinal or intra-articular anesthesia, 279  
total knee arthroplasty, 267-284  
analgesic options, 285-314  
early rehabilitation, benefits of, 249  
goals of pain management, 290  
number performed annually, 285  
pain characteristics, 289-290  
surgical approach, 286-287  
total knee arthroplasty syndrome, 102  
unicompartmental total knee arthroplasty (UKA), 285, 287  
wound infiltration techniques, 250  
periarticular infiltration, 250-252, 277-278, 279  
wound infiltration with local anesthetics, 250-255  
Exparel, 252-255

Length of hospital stay (LOS)  
increased  
with opioid-related adverse events, 26, 27, 41-44, 43  
with poorly controlled postsurgical pain, 13, 21  
number of overnight stays, 13  
reduced with multimodal analgesia, 279, 300

Lidocaine (Xylocaine), 226, 228, 231t

Liposomal injectable suspension. See *Exparel*.

Liver, acetaminophen toxicity, 217-220

Local anesthetics, 226-230, 247-266. See also *Bupivacaine*; *Exparel*.  
actions mechanisms, 117t, 226, 227, 228  
differential blockade of nerve fiber types, 227, 228  
administration  
coadministration of several agents, 252-253, 295  
coadministration with epinephrine, 254, 396  
continuous infusion, 229  
DepoFoam drug delivery system (Exparel), 227, 247, 253, 280  
nerve blocks, 295  
single infusion, 229  
adverse events, 229-230  
agents, 117t, 226  
bupivacaine (Marcaine), 117t, 120, 227, 228, 231t  
cocaine and procaine, 226, 231t



- Local anesthetics, agents (*continued*)
- Exparel (liposomal bupivacaine), 117t, 226-229, 247, 252-255
  - lidocaine (Xylocaine), 226, 228, 231t
  - ropivacaine (Naropin), 117t, 120, 121, 227, 228, 231t
  - amide, 226, 226, 231t. See also *Exparel*.
  - applications/indications, 227-228
  - benefits of, 227-229, 363
  - chemical composition, 226, 226
  - clinical benefits of, 93
  - continuous peripheral neural blockade with, 16, 17, 128
  - disadvantages of, 229-230
  - dosage, 117t, 229, 231t
  - duration of activity, 128, 228
    - addition of epinephrine, 229, 230
    - customization of, 229
  - efficacy, 117t, 120-121, 226-227
    - in vicinity of nerve fiber carrying noxious signals, 227, 228
  - ester-based, 226, 226, 231t
  - indications for
    - ankle and foot surgeries, 362-363
    - knee/hip arthroplasty, 280, 281, 295-296
    - outpatient orthopedic procedures, 380, 383-384
    - trauma surgery, 396
  - infiltration of, 16-17, 119-120, 121
    - with “PainBuster” pumps, 17, 120
  - new and emerging, 247-266. See also *Exparel*.
    - Exparel (liposomal bupivacaine), 247, 252-255, 280
    - nanocaine, 261
    - neosaxitoxin, 259-261
    - SABER-bupivacaine, 248, 258-259, 259
  - postoperative administration, 129
  - preventive/preoperative administration of, 128
  - targets of, 118, 251
  - tolerability and safety, 117t, 229
  - wound infiltration techniques, 250, 261-262, 296, 297-299
    - for knee/hip arthroplasty, 296, 297-299
    - periarticular infiltration techniques, 250-252
    - solutions for infiltration, 255-258
- Lorazepam (Ativan), 125, 234
- Lortab, 157, 166t, 210
- Low molecular weight heparins (LMWHs), 123, 186, 397, 398t
- Lumbar plexus blockade, 294, 306t, 397
- Lumbar spine surgeries, 322-324, 333
- Lyrica. See *Pregabalin*.
- Marcaine. See *Bupivacaine*.
- Mayo Clinic multimodal analgesic regimen, 300, 308t-309t
- Medicare/Medicaid. See *Center for Medicare and Medicaid Services*.
- Meloxicam, 189, 204t
- Meperidine (Demerol), 151-152, 154t, 339, 395
  - oral, 163-164, 166t, 337
- Methadone (Dolophine), 138, 152-153, 154t
  - oral, 162-163, 167t
- Methocarbamol (Robaxin), 233
- Modulation
  - spinal (central) modulation, 75-78, 76-77, 81, 270
  - steps in, 70, 71, 75-78, 76-77
- Morbidity, post-surgical, increased by poorly controlled pain, 85, 89, 91-92
- Morphine, 148-149, 155-156. See also *Patient-controlled analgesia (PCA)*.
  - in combination with periarticular nerve block, 295
  - dose-dependent adverse events, 149
  - dose response, 142
  - epidural infusions and PCEA, 183-184, 185t
  - extended-release (MSContin), 316
  - immediate-release, 318t, 336t
  - intrathecal, 122
  - long-acting, 318t
  - neuraxial, 183-186, 185t
  - oral, 153, 155-156, 337, 337t
    - dosing, 156, 166t, 304t
  - parentally administered, 148-149, 339
    - dosing, 154t
    - for trauma surgery, 394, 395
  - PCA, 44, 173, 178, 185t, 285, 318t, 342t
  - post hospital discharge, 129
  - prolonged-duration epidural (DepoDur), 123
  - recommendations for
    - shoulder replacement, 316
    - spine and back surgeries, 336t, 337, 337t, 342t

Morphine (*continued*)

- short-acting, 318t
  - spinal administration, 122, 278
    - coadministration of bupivacaine or ropivacaine, 123
  - sustained-release (morphine CR, MS-Contin), 49, 153, 166t
- MSContin, 316, 318t
- Multimodal analgesia, 16-17, 109-136, 249-250
- action mechanisms, 112-113, 116t-117t
  - adjuvant agents, 226-246, 278
    - $\alpha$ -agonists, 230-232
    - anticonvulsant analgesics, 235-237
    - corticosteroids, 239-241
    - local anesthetics, 226-230
    - muscle relaxants, 233-235
    - NMDA receptor antagonists (ketamine), 123-124, 237-239
    - tricyclic antidepressants, 241-242
  - advantages vs disadvantages, 113, 114t, 130-131, 279, 300, 385-386
    - cost savings, 300
  - agents, 114, 116t-117t, 226-246
    - combinations of, 262
  - basics on, 112-127
  - cautions and contraindications, 110t, 111t
  - defined, 112
  - dosing, 116t-117t
  - effects of, 112-113
    - reduction of pain intensity, 114
  - efficacy, 116t-117t
  - evolving, 277-280, 278
  - indications for
    - ankle and foot surgeries, 360t-361t, 361, 367-368, 369-370
    - shoulder replacement, 324-326, 325t
    - spine and back surgeries, 345
    - total knee or hip arthroplasty, 267-268, 271-277, 296-300
    - trauma surgery, 400, 401t-402t
  - local anesthetic infiltration, 16
  - Mayo Clinic analgesic regimen, 300, 308t-309t
  - opioid monotherapy vs, 109-112, 127
  - opioid-sparing regimen, 301t
  - pain gaps, opioids for, 274, 275
  - peripheral neural blockade (PNB) in, 16

Multimodal analgesia (*continued*)

- postoperative analgesia, 276t
  - postoperative pain practice guidelines, 110t-112t
  - preventative (preemptive) analgesia, 128-130, 130, 262, 273-275, 276t, 296-300, 362
  - PROSPECT initiative, 131, 131t
  - recommendations for, 109, 110t-112t, 116t-117t
    - administration by set schedule, 277
    - anesthesiologists, 112t
    - discharge medications, 303t
    - intraoperative regimen, 303t
    - perioperative, 110t-111t
    - two analgesic agents, 111t
    - two routes of administration, 111t
  - reduced wound site and CNS pro-inflammatory response, 89
  - safety, 116t-117t
  - targets of, 118, 251
    - conduction, 120-122, 270
    - cortical perception, 125-126, 270
    - descending inhibition, 124-125
    - muscle responses, 125
    - spinal transmission, 122-125, 270
    - transduction, 115-120
  - treatment algorithm for acute pain, 274
  - vs opioids, 109-112, 127
    - reduced opioid burden, 45
- Muscle relaxants, 125, 233-235
- Muscle responses/spasms, as targets for analgesia, 125, 233
- Myelopathic pain, 62
- 
- Naloxone, 141, 142
- Nanocaine, 261
- Naproxen, 189, 336t
  - COX-2 inhibition, 193
- Naropin. See *Ropivacaine*.
- Nausea/vomiting, 23, 41, 109, 142
- Neosaxitoxin, 259-261
- Nerve fibers
  - A $\delta$  fibers, 53, 73, 75, 289
  - c-fibers, 53, 73, 75

- Neural blockade, 249, 276t, 277-280, 278  
 cautions for, 274, 293  
 continuous, 273, 279, 383  
 duration of, 365  
 indications for  
   ankle and foot surgeries, 365-367, 366  
   knee/hip arthroplasty, 293-295, 306-307t  
 preventive/preoperative, 16, 128, 273-274, 276t
- Neuroanatomical plasticity/changes, 75, 82
- Neuroendocrine responses, 95-98
- Neurons  
 dorsal horn, 73  
 nociceptive-specific, 73  
 wide-dynamic range (WRD) neurons, 73-75, 74
- Neuropathic pain, 58, 59t  
 gabapentinoids for, 126
- Neurotransmitters, 81
- Nitric oxide, 96
- NMDA receptor antagonists (ketamine), 123-124, 237-239
- NMDA receptors, 74-75, 76, 94, 96
- Nociception, 53, 54, 70-73  
 gate control theory, 55, 56  
 intensity theory of, 55  
 mediators of, 70-73, 72, 87, 90-91  
   nerve endings, 76-77, 90  
   primary nociceptors, 70-73, 71  
 overview of, 76-77  
 specificity theory of, 55
- Nociceptive pain, 57-58, 59t
- Norepinephrine (NE), 75, 78, 87, 92, 241
- “Noxious soup,” 87, 88
- NSAIDs, 189-208. See also *COX-2 inhibitors*.  
 actions mechanisms, 115, 189-190, 191  
 adverse effects, 190, 192, 319, 335  
   bleeding risk, 190, 192, 204t  
 agents, 115, 116t, 189, 204t  
   injectable/IV administered, 189, 291-292  
     diclofenac, 116t, 196-199  
     ibuprofen (Caldolor), 116t, 193-196  
     ketorolac (Toradol), 116t, 192-193, 291  
   for opioid-dependent/tolerant patients, 147
- NSAIDs, agents (*continued*)  
   oral (meloxicam, naproxen), 189, 204t  
   transdermal (diclofenac patch), 189  
 cautions and contraindications, 115, 190, 319  
   bone growth/implant fusion concerns, 203, 319  
   renal toxicity, 335  
 discontinuance, abrupt, 203  
 dose, 116t, 204t, 327t  
 efficacy, 115, 116t, 201-202, 205  
   coadministration with opioids, 201-203, 202  
   COX-2 selectivity, 193, 204t  
 indications for  
   ankle and foot surgeries, 368, 369  
   outpatient orthopedic procedures, 380, 381  
   shoulder replacement, 317-319, 327t  
   spine and back surgeries, 335-336, 336t, 340-341  
   total knee or hip arthroplasty, 291-292, 293  
   trauma surgery, 394  
 in multimodal analgesia, 89, 111t, 116t, 189  
   recommendations for, 111t, 112t, 116t, 225  
 negative attitudes toward, 37  
 optimizing benefits, while minimizing risks, 200-203  
 post hospital discharge, 129  
 preventive/preoperative administration of, 16, 128, 129  
 reduced opioid adverse effects with, 201-203, 202  
 reduced opioid use with, 111t, 113, 195, 201  
 safety, 116t, 190  
 targets of, 118  
 underprescription of, 37
- Nucynta. See *Tapentadol*.
- Ofirmev (IV acetaminophen), 17, 210-221. See also *Acetaminophen*.
- Older patients. See *Elderly patients*.
- OMS103HP, 385
- Ondansetron, 302t
- Opana. See *Oxymorphone*.
- Opioids, 137-171, 267. See also *specific agents*.  
 acetaminophen (APAP)-containing, 153  
 action mechanism, 126, 139-140  
 addiction, fear of, 38-39, 44-45, 364

Opioids (*continued*)

administration, 147-150  
by the clock, 147-148  
coadministration of other analgesics, 148, 225  
correct use of, 337-338  
neuraxial and epidural PCA, 183-186, 185t  
parenteral, 146-147  
PRN, 148  
subcutaneous injection, 146-147  
adverse events (ORAEs), 41-45, 41, 109-112, 141-144, 273t, 280-282, 316-317, 364. See also *Adverse events*.  
CNS effects, 24-25, 41, 41  
constipation, 109, 142  
cost-related consequences of, 23-26, 27, 42, 43  
dose-dependent, 42, 142  
in elderly, risk for, 42-44, 292  
hospital costs, 25-26, 42-44  
increased LOS, 41-42, 112  
minimizing/treating, 144  
opioid-induced delirium, 24-25, 292  
patient avoidance of, 44-45, 45  
postoperative ileus (POI), 23-24, 109  
reduction in, with NSAID coadministration, 201-203, 202  
respiratory depression, 23, 25, 41, 41, 277, 292  
agents, 138, 154t, 394  
buprenorphine, 141, 164-165  
codeine, 138, 165  
fentanyl, 138, 150-151  
hydrocodone, 129, 153, 157  
hydromorphone, 138, 149-150, 153, 161  
meperidine, 151-152, 163-164  
methadone, 138, 152-153, 162-163  
morphine, 138, 148-149, 153, 155-156  
oxycodone, 153, 156-158  
oxymorphone, 150, 162  
tapentadol, 155, 160-161  
tramadol, 155  
analgesic ceiling effect, 141  
analgesic duration, 141, 143t, 154t, 166t-167t  
benefits and drawbacks, 137, 139t

Opioids (*continued*)

cautions and contraindications, 364  
elderly and cognitively impaired, 146, 317  
opioid-dependent patients, 146-147, 317  
for preventative administration, 128-129  
spinal opioid analgesia, 186  
classification of, 138, 140-141  
agonists, 140-141  
antagonists, 141  
cycle of alternating oversedation and pain gaps, 15  
dosing, 318t  
dose intolerance, 41  
dose response, 141, 142  
“one dose size fits all” philosophy, 44  
oral formulations, 166t-167t  
parenteral formulations, 154t, 337t  
efficacy, 137, 141, 148-153, 165-167  
variability in response, 145-146, 145t  
indications for  
ankle and foot surgeries, 363-365, 367, 369  
breakthrough pain, 137, 274, 367, 369  
in multimodal analgesia, 137  
outpatient orthopedic procedures, 380  
primary analgesic therapy, 137  
as “rescue analgesia,” 364, 369  
shoulder replacement, 316-317, 318t  
spine and back surgeries, 331, 336-337, 336t, 337t, 339  
total knee or hip arthroplasty, 292  
trauma surgery, 394, 395-396  
monotherapy, 20, 36t, 39-45, 40, 42, 126  
multimodal analgesia vs, 109-112, 110t-112t, 127  
National Premier Postsurgical Opioid Outlier Study, 43  
negative attitudes toward, 37  
opioid burden, 42  
reduced with multimodal analgesia, 45, 111t, 112t, 113  
opioid-dependent patients, 146-147, 317, 363-364  
opioid-induced hyperalgesia (OIH), 129, 144-145  
opioid receptors, 139-140, 140  
mu ( $\mu$ ) receptors, 140, 146, 292  
opioid rotation, 145

Opioids (*continued*)

- opioid-sparing regimen, 301t
  - oral, 336-337
    - analgesic dosing, 153-155, 166t-167t, 304t-305t
    - postoperative administration, 129
    - short-acting, 153
    - sustained-release, 49, 153-155
  - overreliance on, 20, 39-45
  - overuse of, 35
  - pain cycles, 148, 173-174, 175
  - pain gaps, 15, 272-273, 275
  - parenteral therapy, 146-147, 154t, 165, 339
    - dosing, 337t
  - pharmacology, 139-141, 142, 143t
  - post hospital discharge, 129
  - targets of, 118
  - tolerance and hyperalgesia, 144-145, 147, 232
  - underprescription, 35, 38-39
  - uptitration of, 39, 40
  - vs multimodal analgesia, 109-112, 127
- Outpatient orthopedic procedures, 375-389, 376
- analgesic agents/methods
    - acetaminophen, 381-382
    - cryotherapy, 384
    - Exparel (liposomal bupivacaine), 383-384
    - multimodal approach, 385-386
    - NSAIDs, 380, 381
    - opioids, 380
    - regional nerve blockade, 380, 382-383
  - basics on, 375-376, 376
  - causes of pain, 376-379
  - perioperative pain management, 379-384
- Oxycodone (Oxycontin), 316
- for ankle and foot surgeries, 364
  - dosages, 166t, 302t, 318t, 336t
  - immediate release, 316
  - oral, 153, 156-157, 166t, 304t, 337
  - post hospital discharge, 129
  - preventative/preoperative administration of, 129
  - prolonged-duration (Xartemis), 49, 129
  - for spine and back surgeries, 336t, 337, 338, 339

Oxycodone (Oxycontin) (*continued*)

- sustained-release (Xartemis XR), 155, 156-158, 159
  - for trauma surgery, 395
- Oxycodone-acetaminophen combination formulations
- Percocet, 156, 158, 159, 209-210, 381
    - dosage, 166t
  - prolonged duration (Xartemis), 49, 129
    - dosage, 166t
  - sustained release (Xartemis XR), 155, 157-158, 159
- Oxycontin. See *Oxycodone*.
- Oxymorphone (Opana)
- IV, 150, 154t
  - oral, 153, 162, 167t

Pain, 53-67. See also *Analgesia; Postsurgical pain*.

- affective-motivational component, 60
- categories and symptoms, 57-58, 59t, 66t
  - mixed pain, 59t, 63
  - neuropathic pain, 58, 59t
  - nociceptive pain, 57-58, 59t
  - physiologic pain, 57, 59t
  - somatic pain, 57
  - visceral pain, 57-58
- characteristics, based on physical exam/history, 66t
- chronic, 21-22, 61-62
- classification of, 53, 57-58, 59t
- clinical context of, 53
- definition of, 53, 57-58
- duration, 53, 58-62, 66t
- effort-dependent, 87, 89, 94
- emotional and cognitive impact of, 98-99
- expectations, patient education on, 37-38, 370
- as "Fifth Vital Sign," 14, 15t, 269, 290
- hyperalgesia, 60
- intensity, 53
- nociception, 53, 54, 73-75
  - overview of, 76-77
- pain pathways, 69-84, 80, 248-249. See also *Surgical pain pathways*.
  - ascending pathways, 73, 79, 80
  - descending control, 80-81, 80, 122, 124-125

Pain, pain pathways (*continued*)  
overview, 80, 251  
targets of multimodal analgesics, 118, 251, 270  
pain perception, 53, 54, 62-65  
anatomical pathways, 69-75, 71, 76-77, 80  
qualitative aspects, 62-65, 66t  
steps in, 69-70, 71  
cortical perception, 71, 71, 270  
descending inhibition, 71, 71, 80-82, 80  
facilitation, 70-71, 71  
modulation, 70, 71, 75-78, 76-77, 270  
spinal reaction, 71, 71  
supraspinal reaction, 71, 71  
transduction, 70, 71, 115-120, 270  
transmission, 70, 71, 81, 122-125, 270, 289  
as target for analgesia, 125-126, 270  
pain processing, 53, 54, 76-77  
gate control theory, 55, 56  
peripheral, 70-73, 72, 90-91  
spinal cord, 72, 73-75, 74, 79, 80  
spinal modulation, 75-78, 76-77, 81, 270  
theories, 55, 56  
pathophysiologic responses to, 85-108  
persistent, 17-18, 85, 101-105  
poorly controlled. See also *Poorly controlled pain*.  
effects of, 13, 21, 60, 85, 248  
pathophysiologic responses to, 85-108, 100  
psychological and social factors in, 270-271, 385  
sensory discriminative component, 60  
temporality and duration, 58-62, 61, 66t  
acute pain, 58-59  
analgesic requirements, 61  
chronic pain, 61-62  
rehabilitative/convalescent pain, 61  
transition from acute to chronic pain, 62, 63, 72, 82, 101, 104  
transmission, 53, 54, 81, 289  
“Pain-Buster” pumps, 17  
Pain cycles, 148, 173-174, 175  
preventing, 279  
Pain gaps, 15, 46-49, 46t, 272-273, 275

Pain management. See also *Postsurgical pain management; Surgeries, specific; and specific agents*.  
Affordable Care Act and, 262-263  
agents  
acetaminophen, 209-223  
analgesic adjuvants, 225-246, 249-250  
local anesthetics, 226-230, 247-266  
multimodal analgesia, 109-136, 249-250  
NSAIDs and COX-2 inhibitors, 189-208  
opioids, 137-171  
current standards of dosing, 14-17  
current status of, 13-34  
educational deficits, 36-37  
enhanced recovery from surgery, 263  
importance of, 104-105, 369  
inadequate  
cost-related consequences of, 20-26  
diminished patient functioning, 20-21  
factors contributing to, 20  
sleep disturbances, 20-21, 98-99  
multimodal analgesia, 16-17, 109-136, 249-250  
adjuvant agents, 226-246, 249-250, 278  
agents, 116t-117t  
perioperative, 110t-111t  
treatment algorithm, 274  
need for improvement, 19-20  
optimal, as patient right, 26  
optimizing benefits, while minimizing risks, 200-203, 282  
patient-controlled analgesia (PCA), 15-16, 47-48, 173-188  
discontinuance of, 16  
supplemented with other analgesic methods, 16  
performance standards, 26-30  
perioperative, 128-130, 130, 379-384  
postsurgical, current effectiveness of, 17-20, 19  
rationales for effective, 15, 15t  
surgical  
achieving goals of, 271-277  
goals of, 269-271, 270, 280  
timing of (in advance of the pain stimulus), 16  
transition to oral medications, 48-49

Paracetamol, 211  
Parenteral nutrition, 98  
Patient-controlled analgesia (PCA), 15-16, 173-188  
  alternatives to, 47-48  
  analgesic window, 176  
  assumptions in, 174  
  dissatisfaction/discontinuance of, 16, 174  
  elderly or disoriented patients, 47-48  
  epidural analgesia (PCEA), 184-186, 185t  
  IV administered, 15, 16, 176-178  
    bolus doses, 176-177  
    devices, 176, 177  
    overstandardization of dosing, 44  
    for spine and back surgeries, 341-343, 342t  
    supplemented with other analgesic methods, 16  
    for trauma surgery, 395-396, 397  
    vs fentanyl ITS, 182t  
  opioids, 318t, 342t  
    fentanyl, 179-180, 342t  
    hydromorphone, 44, 173, 342t  
    morphine, 44, 173, 342t  
  patient education on, 177-178  
  problems with, 16, 47-48  
  recommended applications, 178, 178t, 331  
  safety and efficacy, 178  
  system-related events (SREs), 47  
  transdermal: fentanyl iontophoretic transdermal system  
    (IONSYS), 16, 173, 178-179, 179, 400  
    potential applications, 183t  
    vs IV-PCA, 182t  
  vs continuous epidural infusion, 122  
Patient education  
  on PCA devices, 177-178  
  on postsurgical pain expectations, 37-38, 370  
PCA. See *Patient-controlled analgesia*.  
Percocet, 156, 381  
Performance standards, based on pain management, 26-30  
Periarticular injection/infiltration, 279, 295  
  cocktail of agents, 295  
  wound infiltration techniques, 250-252

Perioperative analgesia, 128-130, 130, 379-384  
  continuous, 129, 383  
  preventative, 128-130  
  recommendations for, 110t-111t, 130  
Perioperative risk factors for pathophysiological responses to surgery, 401t-402t  
Peripheral neural blockade (PNB), 278-280, 293-295. See also *Local anesthetics*.  
  algorithm for, 278  
  cautions for, 274, 293, 382  
  continuous, 273, 279, 383  
  efficacy of, 121-122, 226-227  
  improved sleep and QOL with, 99  
  indications for  
    ankle and foot surgeries, 365-367, 366  
    knee/hip arthroplasty, 293-295, 306t-307t  
    outpatient orthopedic procedures, 380, 382-384  
    shoulder replacement, 320-324  
    trauma surgery, 396-398  
  preventative/preoperative administration, 16-17, 128, 129, 227-228, 320  
  single shot, 383  
Peripheral pain processing, 70-73, 72, 90-91  
Peripheral sensitization, 60, 72, 78-79, 87-89, 88, 90-91  
Persistent pain, 17-18, 101-105  
  incidence of, 102, 103t  
  plasticity changes, 102-104  
  risk factors for, 101, 101  
Phantom limb, preventing chronic pain due to, 130  
Physiologic pain, 57, 59t  
Plasticity, neuroanatomical, 75, 82, 102-104  
PNB. See *Peripheral neural blockade*.  
Poorly controlled pain, 85-108  
  effects of  
    in elderly and critically ill patients, 86t, 95  
    on postsurgical outcomes, 85, 248, 268-269, 268  
    sleep disturbance, 85, 98-99  
  pathophysiological responses to, 85-108  
    central sensitization, 93-95, 102  
    effects on postsurgical outcomes, 85

Poorly controlled pain, pathophysiologic responses to (*continued*)  
 in elderly and critically ill patients, 86t, 95  
 emotional and cognitive impact, 98-99  
 negative CV outcomes and morbidity, 85, 89, 91-92  
 neuroendocrine responses, 95-98  
 outline of, 100  
 peripheral sensitization, 87-89, 88, 90-91  
 pulmonary function, 95  
 sympathoadrenal activation, 89-93  
 prolonged convalescent and persistent pain, 17-18, 101-105  
 risk factors for, 101, 101t, 248

Posimir. See *SABER-bupivacaine*.

Postoperative cognitive dysfunction (POCD), 276-277

Postoperative ileus (POI), 23-24, 109

Postsurgical pain  
 as cause for ER visits and readmission, 13  
 as cause of patient dissatisfaction, 13  
 current effectiveness of, 17-20, 19  
 current management of, 13-34  
 hospital performance standards based on, 14, 26-30  
 intense, number of patients with, 17-18, 19  
 length of hospital stay (LOS) and, 13  
 patient education on, 37-38, 370  
 persistence of, 17-18, 101-105  
 risk factors for, 402t

Postsurgical pain management. See also *Pain management*.  
 adverse events with, 19  
 agents for. See *Pain management*.  
 algorithm for, 403  
 challenges of, 35-52  
 analgesic gaps, 46-49, 46t, 272-273, 275  
 educational deficits, 36-38  
 overreliance on opioid monotherapy, 39-45  
 underprescription of opioids, 38-39  
 current effectiveness of, 17-20, 19  
 inadequate  
 chronic pain syndrome, 21-22  
 cost-related consequences of, 20-22  
 cost-related consequences of opioid-related adverse events,  
 23-26, 27

Postsurgical pain management, inadequate (*continued*)  
 diminished patient functioning, 20-21  
 factors contributing to, 20, 35, 36t  
 hospital readmission, 21, 27  
 longer hospital stays, 21, 26, 27  
 sleep disturbances, 20-21, 98-99  
 multimodal analgesia, 16-17, 109-136, 249-257, 274  
 patient-controlled analgesia (PCA), 15-16, 173-188  
 preventative administration of NSAIDs or peripheral neural  
 blockade (PNB), 16-17, 128-130  
 rationales for effective, 15, 15t  
 timing of (in advance of the pain stimulus), 16

Prednisone, 119, 240, 295

Pregabalin (Lyrica), 117t, 126, 235-237, 274-275, 384  
 dosage, 22, 117t, 126, 235, 236, 293, 327t  
 preoperative, 293  
 efficacy, 117t, 236, 293  
 indications for  
 ankle and foot surgeries, 368  
 shoulder replacement, 319-320, 327t  
 total knee/hip arthroplasty, 292-293  
 post hospital discharge, 129  
 preventative/preoperative administration, 129, 293  
 side effects, 293  
 targets of, 117t, 118

Preventative (preemptive) analgesia, 16-17, 128-130, 130,  
 273-275, 276t, 296-300, 302t, 362, 391-392

Prilocaine, 231t

Procaine, 226, 231t

Propacetamol, 327t, 337t, 340-341

Propoxyphene, 305t

PROSPECT initiative, 131, 131t

Prostaglandin (PGE<sub>2</sub>), 70, 72, 94, 96, 190, 191  
 inhibition of, 115, 191, 240

Pruritis. See *Itching*.

Pulmonary function, 95

Regional anesthesia, 249, 276t, 277-280, 278  
 advantages and disadvantages, 323t, 382, 399t  
 for ankle and foot surgeries, 365-367, 366, 369



Regional anesthesia (*continued*)  
 for knee arthroplasty, 293-295, 306t-307t  
 for outpatient orthopedic procedures, 380, 382-383  
 for shoulder replacement, 320-324  
 for trauma surgery, 396-398

Rehabilitative pain, 61

Respiratory depression, 23, 25, 41, 41, 186, 277, 292

Rofecoxib, 119, 201, 336t, 340

Ropivacaine (Naropin), 117t, 120, 121, 227, 228  
 adverse effects, 230  
 coadministration with spinal morphine, 123  
 dosage, 117t, 231t

Roxicodone, 156, 166t

SABER-bupivacaine (Posimir), 248, 258-259, 259

Saphenous nerve block, 366

Sciatic nerve blockade, 278, 294, 307t, 366, 369-370

Sedation, 142

Sensitization. See also *Hyperalgesia*.  
 central, 60, 72, 82, 93-95, 102  
 preventing, 291-293  
 peripheral, 60, 72, 87-89, 88, 90-91  
 sensitization theory, 55

Serotonin-norepinephrine reuptake inhibitors (SNRIs), 125, 126, 241-242

Serotonin syndrome, 161

Shoulder replacement, 315-330  
 analgesic options, 316-324  
 anticonvulsants, 319-320  
 liposomal bupivacaine (Exparel), 324  
 non-opioid dosing options, 327t  
 opioids, 316-317, 318t  
 regional anesthesia, 320-324, 323t  
 expected pain, 315-316  
 perioperative multimodal pain management, 324-326, 325t

Shoulder surgery, 315-330, 375, 376  
 local anesthetic infiltration, with "Pain-Buster" pumps, 17  
 number of surgeries (annually), 13

Sleep disturbance, 20-21  
 as result of poorly controlled pain, 85, 98-99

Solumedrol, 119

Somatic pain, 57

Spinal analgesia, 78, 278, 278, 294-295, 343-344, 344

Spinal anesthesia, 343-344, 344, 396-397  
 contraindications, 397  
 single shot, 397

Spinal cord, 73-75, 74  
 ascending pathways, 73, 79, 80  
 descending control of pain, 80-81, 122, 124-125  
 modulation of pain signals, 75-78, 76-77, 81, 270  
 pain processing in, 72, 73-75, 74, 76-78

Spinal modulation (of pain), 75-78, 76-77, 81

Spinal reaction to pain, 71, 71

Spinal transmission, 122-125, 270

Spine and back surgeries, 331-350  
 analgesic options, 335-343, 336t  
 gabapentin, 338  
 ketamine, 341  
 multimodal analgesia, 345  
 NSAIDs, 335-336, 336t, 340-341  
 opioids  
 oral, 336t, 337-338, 337t  
 parenteral, 339  
 PCA, 331  
 oral analgesia, 335-339, 336t  
 parenteral therapy, 339-341  
 patient-controlled analgesia (PCA), 341-343, 342t  
 spinal analgesia, 343-344, 344  
 chronic periosteal pain, bupivacaine infusion for, 130  
 endoscopic spine surgery, 334  
 fast-track postsurgical program, 334  
 lumbar spine surgery, 322-324, 333  
 number performed annually, 331  
 pain syndromes associated with, 332-334  
 battered root syndrome, 333, 333  
 conventional open surgical approaches, 332-334, 333  
 endoscopic spine surgery, 334  
 failed back surgery syndrome, 333-334, 333  
 percutaneous endoscopic lumbar discectomy (PELD), 334  
 spinal anesthesia, 343-344, 344

- Spinothalamic tract (STT), 79
- Stress response to injury/acute pain, 86t, 95-98, 401t
- Sublimaze. *See Fentanyl.*
- Suboxone, 164-165
- Substance P, 73, 75, 87
- Subutex, 164-165
- Supraspinal reaction, 71, 71
- Surgeries
- coronary artery insufficiency, 92
  - deep vein thrombosis (DVT), 92-93
  - increased morbidity post-surgery due to poorly controlled pin, 91-92
  - number of outpatient (annually), 13
  - perioperative ischemia, 92
  - perioperative risk factors of pathophysiological responses, 401t-402t
  - postoperative tachycardia, 92
  - sympathoadrenal activation, 89-93
  - venous stasis, 92-93
- Surgeries, specific
- ankle and foot surgeries, 351-374
  - outpatient procedures, 375-389
  - shoulder replacement, 315-330
  - spine and back surgeries, 331-350
  - total joint replacement, 267-284
  - total knee and hip arthroplasty, 285-314, 375-389
  - trauma surgery, 391-405
- Surgical pain pathways, 69-84, 248-249. *See also Pain.*
- anatomical pathways, 69-70, 71
  - ascending pathways, 79, 80
  - descending control, 80-81, 80, 122, 124-125
  - goals of pain management, 269-271, 270, 280
  - hyperalgesia, 60, 78-79
  - overview, 80, 251
  - peripheral pain processing, 70-73, 72
  - spinal cord, 72, 73-75, 74
  - spinal modulation, 75-78, 76-77, 81
  - steps in pain perception, 69-70, 71
  - targets of, 270
- Sympathoadrenal activation, 89-93
- System-related events (SREs), 47
- Tachycardia, postoperative, 92
- Tapentadol (Nucynta), 117t, 124-125, 155, 160-161
- for ankle and foot surgeries, 364
  - extended-release (Nucynta ER), 160
  - oral dosing, 167t
  - serotonin syndrome and, 161
- Tetracaine, 231t
- Three-in-one block, 122
- Thrombosis
- continuous infusion of local anesthetics, 93
  - deep vein thrombosis (DVT), 92-93
- Tizanidine (Zanaflex), 233-234
- Tolerance, 144
- Toradol. *See Ketorolac.*
- Total joint replacement. *See Joint replacement, total.*
- Tramadol (Ultram), 155, 167t, 292
- for ankle and foot surgeries, 364
  - post hospital discharge, 129
  - for spine and back surgeries, 336t
  - for total knee/hip arthroplasty, 302t, 305t
- Transdermal medication delivery, 400
- Transdermal PCA device (IONSYS), 16, 173, 178-179, 179, 400
- Transduction, 70, 71, 115-120, 270
- Transmission, 70, 71, 81, 122-125, 270, 289
- Trauma surgery, 391-405
- adverse “pathophysiologic” effects in high-risk patients, 86t
  - analgesic options for, 393-400
  - acetaminophen, 393-394
  - gabapentin, 395
  - IV-PCA, 395-396
  - morphine, 394, 395
  - NSAIDs, 394
  - opioids, 394, 395-396
  - oral medications, 393-395
  - parenteral therapy, 395
  - perioperative multimodal analgesia, 400, 401t-402t
  - regional anesthesia, 396-398, 399t
  - transdermal medication delivery, 400
  - beneficial “physiologic” effects in healthy adults, 86t
  - pain considerations by surgical approach, 392

Trauma surgery (*continued*)  
postoperative analgesia, algorithm for, 403  
triple response, 87

Tricyclic antidepressants, 117t, 125, 126, 241-242  
action mechanism, 117t, 241  
cautions, 242  
dosage, 117t  
efficacy, 117t, 241-242  
targets of, 118

Triple response, 87

Ultracet, 155

Ultram. See *Tramadol*.

Urination, difficulty with, 23, 25  
urinary retention, 25, 41, 41, 112

Value-Based Purchasing mandates, 28

Venous stasis, 92-93

Vicodin, 166t, 210, 381

Visceral pain, 57-58

WDR (wide-dynamic range) neurons, 73-75, 74, 79, 94

Windup, 75, 123

Wound infiltration, 249, 250, 261-262. See also *Exparel*.  
allowing time for, 25  
basic techniques, 250  
periarticular techniques, 250-252  
solutions for, 255-258  
techniques for knee/hip arthroplasty, 296, 297-299

Xartemis. See *Oxycodone-acetaminophen*.

Xylocaine, 226