

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

- ACE inhibitors, 77-78
- Acetaminophen
  - dosage, liver toxicity and, 244
  - IV, *118*
  - postoperative, 241t, 244, 249t
  - preoperative, 106, 108, 114t-116t, 195, 222, 248t
- Acetyl-salicylic acid, 76
- Addisonian symptoms, 130
- Albumin, 135
- Alcohol intake, 81, 85
- Alpha-2 antagonists, 241t, 246
- Alternative/complementary therapy, 247
- Alvimopan (opioid antagonist), 108-109, 223, 314
- American Society for Enhanced Recovery (ASER), iv, xii
  - anesthetic checklist, 360t-361t
- Ampicillin/sulbactam, 127t
- Anaerobic threshold (AT), 47, 47t
- Analgesia, xxi-xxii, 106-109, 314. See also *Pain management*.
  - bupivacaine, 114t-116t, 195, 238, 242, 248t, 338t, 347t
  - in context of enhanced recovery, 106-109, 314
  - epidural analgesia, 117t, 238-239, 248t, 347t
    - thoracic epidurals, 108, 109, 114t, 116t, *118*, 238-239
  - individualizing care, xxii
  - local anesthetic-based, 114t, 238, 240t-241t, 248t
  - multimodal analgesic regimens in ERAS protocol for
    - abdominopelvic surgery, 106-108, 114t-117t, 314, 317
    - colorectal surgery, 114t
    - flow chart, *118-119*
    - gynecologic surgery, 115t
    - liver resection, 117t
    - pancreatic surgery, 116t
    - peri/postoperative pain control, 237, 247, 248t-249t
    - postoperative ileus prevention, 222
    - radical cystectomy, 116t
  - neuraxial/regional blocks, 106, 108, *118*
  - neuromuscular block, xix

- Analgesia (*continued*)
- nonopioid analgesics, 108
  - opioids, minimization of use, 106, 239
  - patient-controlled analgesia (PCA), 115t, 118, 169, 243, 246, 248t
  - preoperative, 106-120, 114t-117t, 195, 248t
  - intraoperative, 114t-117t, 195, 248t
  - postoperative, 114t-117t, 237-250, 248t-249t
    - options/techniques, 238-247
  - regional techniques, 238-242
  - spinal block, 108, 118
  - transverse abdominis plane (TAP) blocks, 108, 118, 174, 194, 239, 240t, 314, 347t
    - bupivacaine in, 194, 195, 347t
  - wound infiltration, 118, 238, 240t, 242
- Anastomotic leak
- abdominopelvic drains and, 229
  - collagen dissolution by infection, 128
  - with mechanical bowel preparation, 53, 54-55
- Anemia, xviii, 78-79, 85, 91, 128-129, 129t
- preoperative screening for, 128-129
  - treatment of, 129, 129t
  - WHO classification of, 128, 129t
- Anesthesia. See also *specific surgical protocols*.
- aims of care, xvi-xvii
  - ASER anesthetic checklist, 360t-361t
  - epidural, 165-169, 174, 248t
  - ERAS elements, xix-xx
  - fluid consumption, timing before anesthesia, 39, 48, 61
  - local anesthetics
    - bupivacaine, 114t, 195, 238, 242, 248t
    - epidural, 114t, 117t
  - optimizing with ERAS, xvi-xxii
  - propofol for, 108t
  - regional, 165-176, 240t
    - opioid-sparing effects of, 165, 166t, 167, 169, 170, 171, 174, 222
  - spinal anesthesia, 173-174
  - thoracic epidural anesthesia (TEA), 165-169, 166t, 169, 174
  - time for and scheduling, 287
  - transverse abdominis plane (TAP) blocks, 170-172, 171, 172, 287
  - thermoregulation and, 177-178
- Anesthesiologists, xvi-xxii, 277-292. See also *CRNA; Team of caregivers*.
- role of, xiv, xvi-xxii
  - in ensuring compliance, xviii
- Anesthetists. See *Anesthesiologists*.
- Angiotensin-converting enzyme (ACE) inhibitors, 77-78
- Angiotensin II (ATII) receptor antagonists, 77-78
- Antibiotics
- agents, selection, and dosing, 126, 126t, 127t, 128, 190
  - infection prevention bundles, 128
  - intravenous, 190-191, 315
  - oral, with MBP (mechanical bowel preparation), 58, 61, 62, 315
  - preoperative prophylaxis, xix, 126-128, 126t, 127t, 190-191, 315
    - dosing and re-dosing, 126-128, 126t, 127t
- Anticholinergic agents, 113t
- Antidiuretic hormone (ADH), 209
- Antiemetic management, preoperative, 105-106, 109
- antiemetic agents: choice, dosage, and timing, 112t-113t
  - multimodal treatment, 110-111
  - recommendations and indications for, 109
  - risk assessment for PONV, 105-106, 107
  - risk-benefit analysis for use, 109
  - treatment strategies, 106, 108t, 110-111
- Antihistamines, 113t
- Anxiety, 99, 203t
- Aprepitant, 112t
- Arginine, 45, 80, 99
- Arterial waveform analyzers, 155-158, 160
- ASA-PS mortality model, 67, 68t
- ASER. See *American Society for Enhanced Recovery*.
- Aspiration, avoiding, xix-xx
- Assistive devices for mobility, 256
- Audit, xv, 327-330
- Authority, decision-making, 295
- Automated scheduling, 283-286, 286
- Binders, abdominal, 256
- Bioimpedance and bioreactance, 158-159
- BiPeglyte, 59
- Bleeding risk, VTE prophylaxis and, 122t-123t, 125

- Blood transfusion, 79, 203t, 204
  - autologous, discouraged in anemia, 129
- Bowel function
  - glutamine and, 45
  - ileus prevention, 219-223, 220
- Bowel preparation, 53-64
  - MBP (mechanical bowel preparation), 53-64
    - efficacy in colorectal surgery, 53-58, 54-57, 62
    - ER protocols and, 61-62, 63
    - types of preparations, 59-61, 60t
- Bupivacaine
  - in colorectal surgery, 114t
  - contraindications, 347t
  - epidural analgesia with, 116t, 238, 248t, 338t, 347t
  - epidural anesthesia with, 248t
  - FDA-approved indications for, 195
  - intraoperative analgesia with, 114t, 115t, 116t
  - liposomal, 195, 242, 347t
  - in multimodal pain regimens in abdominopelvic surgery, 114t, 248t, 338t, 347t
    - gynecological surgery, 115t
    - pancreatic surgery, 116t
  - opioid-sparing with, 242
  - with peritoneal infiltration/catheters, 242
  - postoperative analgesia with, 114t, 242
  - in TAP blocks, 194, 195, 347t
- Business case for ERAS, 287-290, 311-318
  - cost benefits, 315-316
- Butyrophenones, 113t
  
- C-reactive protein, high-sensitivity (hsCRP), 75-76
- Cachexia, 41
- Cancer. See also *Chemotherapy*.
  - cachexia due to, 41
  - gyn-oncology surgery protocol, 243t-244t
  - neo-adjuvant therapies, 46, 74, 82
  - patient education and conditioning of expectations, 83
  - prehabilitation and, 90
- Carbohydrate drinks/loading, 40, 48, 61, 62, 202, 203t, 207-208, 221, 304-305
- Carbohydrate metabolism, 207-208
- Cardiac output (CO), 133, 151, 153, 154
- Cardiopulmonary exercise, 46-48, 47t
- Cardiovascular benefits, of thoracic epidural anesthesia, 167
- Cardiovascular responses to surgery, 208-209
- Cardiovascular risk, 77
- Catheters, 230-232, 233t. See also *Tubes, drains, and catheter management*.
  - paravertebral, 239-242, 240t
  - TAP, 239, 240t
  - urinary, 230-232, 233, 233t
  - wound and peritoneal, 240t, 242
- Cefazolin, 126t, 127, 127t
- Celecoxib, 115t, 118, 195, 248t
- Cell-mediated immunity, 208
- Central venous access, 232-234
- Certified registered nurse anesthetist (CRNA), xvi-xxii
- Challenges, overcoming, 277-310
  - anesthesiologists, 277-292
  - clinical implementation gaps (CIGs), 278-279, 279, 280t
  - nurses and support staff, xxiv-xxv, 301-310
  - surgeons, 293-300
- Change. See also *Challenges, overcoming; Implementation*.
  - barriers to, xxiv-xxv, 287-290, 293-294, 301-309
  - change management, 280-282, 281t, 284-285
  - Change Management Model (Kotter), 280, 282, 284-285
  - negative emotions and, 282
  - organizational, 278
  - psychological aspects of, 282, 290
  - Transitional Model (Bridges), 280, 282
- Charlson mortality model, 67, 69t
- Chemotherapy
  - CPET in evaluation of impact of, 74
  - exercise training and, 46, 82
  - timing of surgery after, xviii, 46
- Ciprofloxacin, 126t, 127t
- Clavien-Dindo classification, 264-265, 269t
- Clearfast, 40
- Clinical implementation gaps (CIGs), 278-279, 279, 280t
- Clinical outcomes, 263-265, 266-268, 269t
- Clonidine, 246
- Clostridium difficile* colitis, 126
- Collagen dissolution by infection, 128

Colorectal surgery, 345t-351t  
   analgesic regimens, 114t, 248t-249t  
   laparoscopic colectomy, 312-313  
   MBP (mechanical bowel preparation) for, 53-64  
   anastomotic leak with, 53, 54-55  
   efficacy of, 53-58, 54-57, 62  
   ER protocols and, 61-62, 63  
   oral antibiotics with, 58, 61, 62, 315  
   surgical site infection (SSI) and, 53, 56-57, 58  
   types of preparations, 59-61, 60t  
   nutritional prehabilitation for, 99  
   outcomes of ERPs, 271-273, 272t  
   pictogram of, 35, 35  
   protocol, 345t-351t  
 Colyte, 59, 60t  
 Communication, within surgical/care team, 190, 196, 255  
 Comorbidities, 65, 91, 102  
 Compliance, xviii, 327-330, 328, 329  
 Complications, 121-132  
   Clavien-Dindo classification, 264-265, 269t  
   fluid therapy, importance for, xvi  
   hypothermia and, 181-182, 182t  
   infections, 80-81, 315  
   malnourished patients and, 41  
   perioperative corticosteroid management and, 130-131  
   postoperative  
     preoperative health status and, 89  
     preoperative prophylaxis of, 121-132  
   as predictive of long-term survival, 76  
   preoperative medical prophylaxis of, 121-132  
     anemia, 128-129, 129t  
     antibiotic prophylaxis, 126-128, 126t, 127t, 190, 315  
     diabetes management, 129-130  
     VTE prophylaxis, 121-125, 122t-123t  
   rate after abdominopelvic surgery, 89  
   reduction  
     with ERAS, xiii, 62, 273  
     importance of, 76-77  
   reporting of, 264-265, 269t  
 Compression stockings/devices, xix, 121  
 Control charts, 325-327, 326  
 Corticosteroids, 130-131  
   as antiemetic agents, 112t  
   perioperative management of, 130-131, 191  
   PONV reduction with, 131  
   for postoperative pain, 241t, 246  
 Cortisol, 206  
 Costs, economic outcomes of surgery, 265-271  
 Cosyntropin stimulation testing, 130  
 COX-2 inhibitors, 243-244  
 CPET (cardiopulmonary exercise testing), 46-47, 48-49, 73-75, 93  
   advantages and disadvantages, 73-75  
   causes of exercise limitation identified by, 73  
   cost of, 74  
   setup for, 74  
   variables derived from, 73  
 CRNA (certified registered nurse anesthetist), xvi-xxii  
 Cystectomy. See *Radical cystectomy*.  
 Dalteparin (Fragmin), 125  
 Dashboard, 330  
 DASI (Duke Activity Status Index), 72  
 Data collection, 320-323, 330  
   surrogate data elements, 324, 324  
 Decision-making authority, 295  
 Depression, 99  
 Dexamethasone, 106, 112t, 131, 246  
 Dexmedetomidine, 246  
 Dextromethorphan, 246  
 Diabetes, 80-81, 129-130  
   diabetic gastroparesis, 221  
   pseudodiabetes of injury, 207  
 Diamorphine, 195  
 Diffusion of practice, 297-298, 298  
 Dimenhydrinate, 113t  
 Discharge, 256-259, 294  
   instructions for, 259  
   preparation for, 256-257  
   readiness for, 257-258  
   resources for, 294  
 Dolasetron, 113t

- Drains, 194, 227, 229-230, 233  
 abdominopelvic, 229-230, 233  
 securing before patient mobilization, 254-255
- Drinks, nutritional, 39, 40, 48, 61
- Droperidol, 113t
- Duke Activity Status Index (DASI), 72
- Duke Enhanced Recovery distal pancreatectomy procedure, 352t-355t
- Duke Enhanced Recovery Whipple Procedure protocol, 356t-359t
- Economic outcomes of surgery, 265-271
- Education. See *Patient education*.
- Education materials, 32-35, 294, 304
- Endocrine mediators of surgical stress response, 206
- Enhanced recovery after surgery (ERAS). See *ERAS*.
- Enhanced recovery protocol (EPR). See also *ERAS*;  
*Outcomes*.  
 characteristics of successful, 333  
 cost savings, 287-290  
 ensuring success and sustainability, 319-332  
 history of, 271, 277  
 incorporation of regional anesthesia technique into, 165, 174  
 outcomes of, 263-274  
 system of care, 319-320
- Enoxaparin (LVNX), 124-125
- Enterococcus*, 128
- Ephedrine, 113t
- Epidural analgesia, 114t, 238-239, 248t, 347t
- Epidural anesthesia, 117t, 248t  
 thoracic (TEA), 165-169, 166t, 169, 174
- Epogen, 129
- ERAS (enhanced recovery after surgery)  
 audit in, xv, 327-330  
 automated scheduling, 283-286, 286  
 business case for, 287-290, 311-318  
 cost benefits, 315-316  
 compliance with, xviii, 327-330, 328, 329  
 coordination of care, 259  
 cost savings, 287-290  
 elements of  
 preoperative, xviii, 27-132  
 ERAS (enhanced recovery after surgery), elements of  
 (*continued*)  
 intraoperative, xix-xxi, 133-214  
 postoperative elements, 215-276  
 outcomes, 263-276  
 ensuring success and sustainability, 319-332. See also  
*Implementation of ERAS*.  
 ERP coordinator, full-time, 308  
 evaluation/performance measures, 320-327  
 goal of, xiii, 309  
 implementation of, xv, 277-332. See also *Implementation  
 of ERAS*.  
 monitoring, 320-330  
 outcomes of, 263-276  
 overcoming challenges, 277-310  
 anesthesiologists, 277-292  
 nurses and support staff, 301-310  
 surgeons, 293-300  
 overview  
 for anesthetist/CRNA, xvi-xxii  
 for nurses, xxiii-xxvi  
 for surgeons, xiii-xv  
 postoperative analgesia in, 238-247, 240t-241t, 248t-249t  
 protocols, 333, 334t-361t. See also *Protocols*.  
 MBP (mechanical bowel preparation) and, 61-62, 63  
 outcomes of, 263-276  
 reduction in complications with use of, xiii, 62, 273  
 standardization of care, 278, 317  
 surgeons, principles for, xiv-xv  
 surgical stress response and, 210-212, 211  
 system of care, 319-320  
 team of caregivers in, xiii-xiv, 174, 293, 296-298, 309  
 ERP. See *Enhanced recovery protocol*.  
 Erythromycin, 61  
 Esophageal doppler, 134, 143, 152, 153, 154-155, 160  
 vs bioimpedance, 158-159  
 Esophageal resections, nutrition after, 218  
 Evaluation/performance measures, 320-330  
 Exercise. See *Physical exercise*.  
 Exparel. See *Bupivacaine*.  
 Expectations, patient's, education and conditioning of, 83,  
 85, 293-294, 304

Fasting, preoperative, 39-40, 48, 61, 202, 203t, 215  
Fatigue, postoperative, 89, 92, 251, 254, 258  
Feedback, xxv-xxvi, 298, 330-331  
Fentanyl, 114t, 117t, 239  
Fluid management strategies, 133-149  
  flow-related parameters/monitoring, 133, 134, 156-157.  
    See also *Hemodynamic monitoring*.  
    algorithm for choice of hemodynamic monitoring during surgery, 138-139  
    available monitoring devices, 154-159  
    cardiac output (CO), 133, 151, 153, 154  
    corrected aortic flow time (FT<sub>c</sub>), 133, 143  
    esophageal doppler, 134, 143, 153, 154-155, 160  
    inter-device differences in, 156-157  
    oxygen delivery index, 144, 146  
    pleth variability index (PVI), 133, 136, 140, 158  
    protocol based on Gray Zone Approach, 142  
    pulse pressure variation (PPV), 137, 142, 145  
    stroke volume (SV), 133, 134, 143, 153, 154  
      real-time, 160  
    stroke volume variation (SVV), 133, 137, 142, 145  
  fluid administration, 135  
    crystalloid vs colloid, 135  
    reducing variability in, 134  
    zero balance strategy, 159, 160  
  goal-directed therapy (GDT/GDFT), 133, 151-163  
    automated scheduling example, 283-286, 286  
    esophageal doppler-based fluid management algorithm, 152, 153  
    euvolemic state, maintenance of, 134, 152, 159  
    fluid responsiveness concept, 153-154, 156-157, 160, 287  
    identifying patient risk, 136, 138-139  
    improved outcomes with, 134  
    NICE protocol, 137, 141  
    in perioperative period, 134  
    protocol based on esophageal doppler monitoring using stroke volume and corrected flow time, 143  
    protocol based on pleth variability index (PVI), 140  
    protocol based on PPV/SVV alone, 144, 145  
    protocol based on PPV/SVV and stroke volume monitoring based on Gray Zone Approach, 142  
    protocol for low-risk surgery, 136, 140

Fluid management strategies, goal-directed therapy (GDT/GDFT) (*continued*)  
  protocol for moderate- and high-risk surgery in patient with an arterial line, 137-144, 141-143  
  protocol for moderate- and high-risk surgery in patient without an arterial line, 137, 141  
  protocol in operating room, 136, 138-139  
  sample protocol/algorithm, 288-289  
  St. Georges protocol based on oxygen delivery index, 144, 146  
  sweetspot concept of, 152, 154  
  perioperative goal-directed therapy (PGDT), 133-134, 144, 152, 153, 159  
  protocols for, 135-144, 138-143, 145-146  
  restrictive crystalloids administration, 134  
  resuscitation goal in critically ill patients, 135  
  SAFE study, 135  
Fluid therapy, 151-163. See also *Fluid management strategies; Hemodynamic monitoring; and specific surgical protocols*.  
  fluid overloading, 203t, 209, 232  
  fluid responsiveness concept, 153-154, 156-157, 160, 287  
  goal-directed therapy (GDT/GDFT), 133, 151-163.  
    See also *Fluid management strategies*.  
    automated scheduling example, 283-286, 286  
    available devices for hemodynamic monitoring, 154-159  
    historical background, 151-152  
    inter-device differences in monitoring, 156-157  
    sample protocol/algorithm, 288-289  
  importance of, xvi  
  infusion of intravenous fluid (IVF), 151, 152  
  intraoperative, xvi, xx, 204  
  MBP with oral antibiotics, reduction in need for fluids with, 62  
  perioperative goal-directed therapy (PGDT). See *Fluid management strategies*.  
  spinal anesthesia and, 173  
  therapeutic endpoints of IV fluid management, 152-154, 156-157  
  volume-based outcomes, 264, 266-267  
Fluids  
  hemodynamic monitoring, 151-163  
  optimization during anesthesia, xvi

Fluids (*continued*)  
 shifts during operative period, xxi, 221-222  
 timing before surgery for consumption of, xviii, 39, 48, 61, 62, 221, 287

Fondaparinux (Arixtra), 125

Food. See also *Liquids; Nutrition*.  
 NPO directions, 39, 215  
 timing before surgery, xviii, 39-40, 61

Functional capacity, 72-75, 89, 92. See also *Physical capacity*.  
 assessments of, 72  
 CPET, 73-75, 74, 93  
 exercise training/programs, 45, 46-49, 92-95  
 as measure of risk, 72-75  
 prehabilitation and, 45-48, 89-91, 92-95, 102-103  
 preoperative assessment of, 72-75

Functional reserve, 102

Gabapentin/gabapentinoids, 106, 108, 115t, 118, 195, 222, 248t  
 dosing, 244  
 postoperative, 241t, 244-245, 249t  
 side effects, 244-245

Gastrectomies, 217

Gastric cancer surgical outcomes, 272t

Gastric resection, 272t, 273

Gastrointestinal surgery/ileus, 219-223

Gatorade/Gatorade Prime, 40, 61, 62

Glucocorticoids, 241t, 246

Glucose, hyper/hypoglycemia, 40

Glucose control, 80-81, 129-130, 207  
 perioperative levels, xix, 40

Glutamine, 45

Goal-directed therapy (GDT). See *Fluid management strategies; Fluid therapy*.

“Golden Circle,” 296-297, 297

GoLYTELY, 59, 60t, 61, 62

Granisetron, 112t

Gynecologic surgery  
 analgesic regimens, 115t  
 outcomes, 274  
 protocol, 243t-244t

HalfLyteLy, 59, 60t

Haloperidol, 113t

Health literacy, 28-29, 36

Heart rate, in exercise programs, 93-94, 96t, 98t

Hemodynamic monitoring and goal-directed fluid therapy, 151-163. See also *Fluid management strategies; Fluid therapy*  
 algorithm for choice of hemodynamic monitoring during surgery, 138-139  
 available devices, 154-159  
 arterial waveform analyzers, 155-158, 160  
 bioimpedance and bioreactance, 158-159  
 device or no device, 159  
 esophageal doppler, 154-155, 160  
 photoplethysmography-based devices, 158  
 volume clamp-based devices, 158  
 esophageal doppler-based fluid management algorithm, 152, 153  
 flow-related parameters/monitoring, 133, 134. See also *Fluid management strategies*.  
 cardiac output (CO), 133, 151  
 fluid responsiveness concept, 153-154, 156-157, 160, 287  
 infusion of intravenous fluid (IVF), 151, 152  
 inter-device differences in monitoring, 156-157  
 oxygen supply:demand matching, 151  
 perioperative goal-directed therapy and fluid management, 133-134, 144, 152, 153, 159  
 sweetspot concept of GDT, 152, 154  
 therapeutic endpoints of IV fluid management, 152-154, 156-157  
 zero balance strategy, 159, 160

Hemodynamic stability, hypothermia and, 182

Hemoglobin determination, 79

Hemoglobin levels, xx

Heparin, 122t-123t, 124-125

Home health care, 258

Hospital stay, length of. See *Length of stay (LOS)*.

Hydromorphone, 115t, 239, 248t, 249t

5-Hydroxytryptamine receptor antagonists, 112t-113t

Hyperglycemia, 40, 207

Hypertension, 77-78  
 treatment of, 76, 77-78

Hypothermia, 179-186, 180  
complications and classifications of, 181-182, 182t  
mild, moderate, severe, 181-182  
monitoring, preventing, and treating, 183-186, 185t, 203t  
postoperative, 185-186  
standardized approach in ERP, 185t

Ibuprofen, 117t, 118, 249t

Ileus prevention, 219-223, 220

Duke approach, 223

Immunological responses to surgery, 208

Immunonutrition, 44-45, 80, 99

Immunosuppression, postoperative, 208

Implementation of ERAS, xv, 277-332

audit, xv, 327-330

barriers to change, xxiv-xxv, 287-290, 293-294, 301-309

care providers, 305-306

identifying by drafting a new ER protocol, 302

organizational factors, 307-309

patient preparations, 303-304

practice change, 302-303

practice setting, 306-307

staff education, 304-305

business case for, 287-290, 311-318

cost benefits, 315-316

“champions” for, 283, 294, 302, 306-307

change management, 280-282, 281t, 284-285

clinical implementation gaps (CIGs), 278-279, 279, 280t

compliance, xviii, 327-330, 328, 329

consensus, reaching, 283, 287, 296-297, 297, 306

diffusion of practice, 297-298, 298

ensuring success and sustainability, 279, 319-332

dashboard, 330

data collection, 320-323, 324, 324, 330

information analysis, 325-327, 326

information management, 323-324

maintaining quality, 327-330

measurement of quality, 320-323, 321, 322

statistical process control charts, 325-327, 326

system dynamics, 323

ERP coordinator, full-time, 308

feedback and, xxv-xxvi, 298, 330-331

Implementation of ERAS (*continued*)

incentives or rewards, 296

organizational change and, 278

organizational design, 294-296

organizational support and, 279, 294, 307-309

overcoming challenges

anesthesiologists, 277-292

nurses and support staff, 301-310

surgeons, 293-300

performance evaluation, 295-296, 320-330

stakeholders, identifying and motivating, 290, 294,

296-297, 297, 302

system of care, 319-320

team of caregivers, xiii-xiv, 174, 293, 296-298, 309

uniform and standardized clinical practice, 278, 317

Incremental Shuttle Walk Test (ISWT), 72

Individualization, xxii, 48

Infection, 80-81, 315

antibiotic prophylaxis, preoperative, 126-128, 126t, 127t,  
190-191, 315

hypothermia and, 181

infection prevention bundles, 128

surgical site (SSI)

antibiotics and, 127-128, 191, 315

MBP and, 53, 56-57, 58

reduction with ERPs, 315

transfusion of red blood cells and, 204

urinary tract, 231

Inflammatory response, 75, 191, 204

Information analysis, 325-327, 326

Information management, 323-324

Insulin resistance

postoperative, 39, 207

preoperative nutrition and, 39-40, 207, 221

Insulin sensitivity, surgical trauma and, 39-40

Insulin therapy, 130, 200, 201, 207, 208

Internet, reliable websites on, 31-32

Intraoperative analgesia, xxi, 114t-117t, 248t

bupivacaine infusion, 114t, 248t

epidural hydromorphone, 114t

IV opioids, 115t

local anesthetic infiltration of bupivacaine, 115t



Intraoperative analgesia (*continued*)  
 magnesium, 248t  
 opioids, 114t

Intraoperative aspects, xix-xxi, 133-214. See also *specific topics*.  
 fluid management strategies, xx, 133-149  
 hemodynamic monitoring and goal-directed fluid therapy, 151-163  
 normothermia, maintaining, 177-188  
 regional anesthesia, role of, 165-176  
 surgical approaches and techniques, 189-197  
 surgical stress response and ERAS, 199-214

Intraoperative techniques for preventing hypothermia, 183-185, 185t

Iron infusion, 203t

Ischemia, 76, 77, 167, 209

Johns Hopkins Hospital, perioperative multimodal analgesic regimen, 248t-249t

Kehlet, Henrik, viii, xii, 199, 271

Ketamine, 106, 108, 115t, 118, 246

Ketorolac, 115t, 116t, 118, 243, 249t

Kotter, John, 280, 282, 284-285

Laparoscopic surgery, 189, 191-194, 217, 312-313  
 analgesia regimens, 108, 114t, 248t  
 in combination with ERPs, 189  
 liver resection, 337t-341t  
 mini-laparotomy, 189  
 neuromuscular block in, xix  
 pancreatectomy, 352t-355t  
 spinal block, 108, 118  
 TAP block and, 171-172

Leadership  
 in change management, 280-282, 281t  
 surgeons, role of, xiii, xiv-xv

Length of stay (LOS), xiii, 264, 268, 271, 273, 312, 316  
 compliance with ERAS and, 328, 328, 329  
 malnutrition as predictor of, 41  
 outcomes for specific surgeries, 271-274  
 POI and, 219  
 reduction with pre-op. use of MBP and oral antibiotics, 62

Levofloxacin, 128

Lidocaine, 106, 108, 118, 241t, 245, 248t, 249t

Liquids, timing of consumption before surgery, xviii, 39-40, 61, 62, 221, 287

Literacy, health, 28-29, 36

Liver resection  
 analgesic regimens, 117t  
 protocol, 337t-341t

Liver surgery outcomes, meta-analyses of, 272t, 273

LMWH, 124-125

Local anesthesia, 106

Local anesthetic-based analgesia, 114t, 238, 240t-241t, 248t

Magnesium, 246, 248t

Magnesium citrate, 59, 60t, 63

Malnourished patients, detection and treatment, 41-45, 42t-43t, 48

MBP (mechanical bowel preparation), 53-64  
 efficacy in colorectal surgery, 53-58, 54-57, 62  
 anastomotic leak, 53, 54-55  
 with oral antibiotics, 58, 62, 315  
 surgical site infection (SSI), 53, 56-57

ER protocols and, 61-62, 63  
 oral antibiotics with, 58, 61, 62, 315  
 types of preparations, 59-61, 60t  
 brand names, 59, 60t  
 hyperosmotic preparations, 59-61, 60t, 63  
 polyethylene glycol (PEG), 59, 60t, 61, 63

Measurement of quality, issues with, 320-323

Mechanical bowel preparation. See *MBP*.

Mental disability, patients with, 218

Metabolic conditioning, 40

Metabolic Equivalent of a Task (MET), 72

Metformin, 81

Methylprednisolone, 112t

Metronidazole, 61, 126t, 127, 127t

Midazolam, 114t, 248t

Minimally invasive surgical approaches, 192, 196, 212, 217, 222

MiraLax, 59

Mobilization, postoperative, 203t, 205, 251-256  
 abdominal binders and, 256  
 assistive devices, 256

- Mobilization, postoperative (*continued*)
- barriers to, 254-255
  - baseline assessment prior to surgery, 252-253, 253t
  - deconditioning and, 89, 251-252, 254
  - discharge preparation, 256-257
  - early mobilization, benefits of, 124, 217, 251-252
  - importance of, 78, 251-252
  - initiating from supine position, 256-257
  - log roll method, 257
  - thoracic epidurals as facilitating, 124
  - timing of, importance to ERAS, 252
  - written orders for, 303
- Monitoring ERP success, 320-330
- Morphine, 116t, 118, 239
- intrathecal, 173
- Mortality models, 67, 68t-71t
- MoviPrep, 59, 60t
- Multimodal treatment
- analgesia, 106-108, 114t-117t, 222, 237, 314, 317
  - PONV management, 110-111
- Myocardial injury, 76, 208
- Narcotics. See *Opioids*.
- Nasogastric tubes, 194, 215-216, 228-229
- avoidance if possible, 228-229
  - decompression with, 228-229
  - legitimate/emergency needs for, 218, 229
- Nausea
- postoperative ileus and, 219, 220
  - postoperative, mobility and, 255
  - postoperative nausea and vomiting (PONV), 105-106, 109
- Neomycin, 61
- Nephrectomy, 274
- Neuraxial local anesthetics, 240t
- Neuraxial opioids, 239, 240t
- Neuraxial/regional anesthesia, 106, 118
- Neurokinin 1 (NK1) receptor antagonists, 112t
- Neuromuscular block, xix-xx
- Nitrogen, urinary, 206, 210
- Nitrous oxide (N<sub>2</sub>O)
- avoidance if possible, xix, 108t
  - surgical stress response and, 205
- NMDA antagonists, 241t, 245-246
- Nonsteroidal anti-inflammatory agents. See *NSAIDs*.
- Normothermia, maintaining, 177-188
- core temperature/set point, 177-178, 180, 183
  - hypothermia
    - complications and classifications of, 181-182, 182t
    - monitoring, preventing, and treating, 183-186, 185t
    - pattern and stages of, 179, 180
    - postoperative, 185-186
    - routes of heat transfer, 178, 178t
    - standardized approach in ERP, 185t
    - surgical factors affecting, 178t, 179
    - thermoregulation principles, 177-178
- NPO, 39, 215
- NSAIDs, 106, 108, 114t, 118, 195, 241t, 243-244
- NuLytely, 59, 60t
- Nurses. See also *Team of caregivers*.
- barriers to change, xxiv-xxv, 301-309
  - CRNA (certified registered nurse anesthetist), xvi-xxii
  - feedback for, xxv-xxvi
  - key concepts for success, xxv-xxvi
  - overcoming challenges, 301-310
  - overview of ERAS participation, xxiii-xxvi, 301, 303
  - patient education by, xxvi, 27, 303-304
  - rationale for procedures and, xxiv-xxv, 305
- Nutrition, preoperative, 39-52, 79-80, 95-99. See also *Nutrition, postoperative*.
- carbohydrate loading, 40, 48, 61, 62, 202, 203t, 207-208, 221, 304-305
  - diabetes management and, 130
  - detection of malnourished patients, 41, 42t-43t, 48, 79
  - immunonutrition, 44-45, 80, 99
  - insulin resistance and, 39-40, 221
  - NPO directions, 39, 215
  - nutrition risk/scoring systems, 42t-43t, 79
  - nutritional drinks, 39, 40, 48, 61
  - nutritional reserve, for postsurgical period, 95
  - nutritional supplementation, 40, 44, 79-80, 95-99, 130-131
    - with protein, 95-99
  - optimization of, 79-80
  - parenteral nutrition, 44
  - physical activity integrated with, 99

- Nutrition, preoperative (*continued*)  
 prehabilitation with, 95-99, 102  
 tumor-related cachexia, 41
- Nutritional drinks, 39, 40, 48, 61
- Nutrition, postoperative, 215-218  
 background, 215-216  
 eating normal food, 216  
 nasogastric tubes, 194, 215-216, 218  
 parenteral or enteral feeding, 216  
 patient education about, 216-217  
 recommendations, 216-218  
 special considerations for immediate postoperative feeding, 218
- Obesity, 80, 91
- Occupational therapy, 253
- Omega-3 fatty acids, 45, 80, 99
- Ondansetron, 112t
- Opioids, 240t, 242-243  
 adverse/side effects of, 106, 174, 222, 239, 240t, 243  
 alternative modalities, 106-108  
 in analgesic regimens in ERAS protocols, 114t-117t, 118, 248t-249t, 314  
 for breakthrough pain or block failure, 108, 249t  
 hydrophilic vs lipophilic, 239  
 IV, 118  
 minimization of use, 106, 108t, 217, 243, 314, 317  
 bupivacaine and, 242  
 regional anesthesia and, 165, 166t, 167, 169, 170, 171, 174, 217, 239  
 mu-opioid receptor antagonist, 223, 314  
 neuraxial, 239, 240t  
 oral (oxycodone, tramadol, morphine), 118  
 peripheral opioid antagonists (alvimopan) to reduce postoperative ileus and constipation, 108, 223, 314  
 respiratory depression and, 174  
 single-shot spinal opioid, 239  
 systemic, 116t, 240t
- Organizational design, 294-296
- Organizations  
 change and, 278  
 support for ERAS, 279, 294
- Orthostatic hypotension, 255
- Orthostatic intolerance, 209
- Outcomes of ERPs, 263-276  
 clinical outcomes, 263-265, 266-268, 269t  
 Clavien-Dindo classification, 264-265, 269t  
 volume-based outcomes, 264, 266-267  
 defined and explained, 263-271  
 economic outcomes, 265-271  
 patient-reported outcomes, 265, 270  
 specialty-specific, 271-274, 272t  
 colorectal, 271-273  
 hepatobiliary, 272t, 273
- Oxycodone, 115t, 117t, 118
- Oxygen deficit/demand, tissue, xxii, 73, 77
- Oxygen delivery index, 144, 146
- Oxygen supply:demand matching, 151
- Pain. See also *Analgesia; Pain management*.  
 after discharge, incidence of, 105  
 management, multimodal approach, 106-108, 114t-117t, 222, 237, 247, 317  
 patient-reported outcomes, 265, 270  
 postoperative, xxii, 105, 237, 247  
 goals of pain control, 237  
 incidence of, 105  
 visual analog scale/scores, 265, 270
- Pain management, preoperative, 106-120, 114t-117t, 195  
 acetaminophen, 106, 108, 114t-116t, 115t, 195, 222, 248t  
 celecoxib, 115t, 118, 195, 248t  
 gabapentin, 106, 108, 115t, 118, 195, 222, 248t  
 multimodal analgesic regimens in ERAS, 114t-117t, 222, 248t  
 preference and recommendation for, 105  
 preoperative “cocktail,” 195  
 thoracic epidurals, 108, 109, 114t, 116t, 118
- Pain management, intraoperative, 114t-117t, 195
- Pain management, postoperative, 114t-117t, 237-250  
 intrathecal opioids during surgery, 173  
 multimodal analgesic regimens, 114t-117t, 237, 247, 248t-249t, 314, 317  
 opioid-sparing, with regional anesthetic techniques, 165, 166t, 167, 169, 170, 171, 174, 222

Pain management, postoperative (*continued*)  
options/techniques, 238-245, 240t-241t, 248t-249t  
acetaminophen, 241t, 244  
gabapentinoids, 241t, 244-245  
NSAIDs and COX-2 inhibitors, 241t, 243-244  
opioids, 240t, 242-243  
patient-controlled analgesia (PCA), 243, 246, 248t  
regional analgesia, 238-239  
epidural analgesia, 238-239  
neuraxial opioids, 239, 240t  
paravertebral blocks/catheters, 239-242, 240t  
TAP blocks/catheters, 239, 240t  
wound and peritoneal infiltration/catheters, 240t, 242  
other adjuvant agents, 245-247, 249t  
alpha-2 antagonists, 241t, 246  
alternative/complementary therapy, 247  
glucocorticoids, 241t, 246  
lidocaine, IV and transdermal, 241t, 245  
NMDA antagonists, 241t, 245-246  
tramadol, 241t, 245, 249t  
preoperative management preferred over, 105  
regional anesthetic techniques and, 165, 173, 240t  
Palonosetron, 112t  
Pancreatic surgery  
analgesic regimens, 116t  
drains, need for, 230  
outcomes, meta-analyses of, 272t, 273  
protocol, 352t-355t  
Whipple Procedure, 217, 218, 273, 356t-359t  
Paracetamol. *See Acetaminophen.*  
Paravertebral blocks/catheters, 239-242, 240t  
Parenteral nutrition, 44  
Patient-centered care, 28  
Patient education, 27-38, 90, 303-304  
about expectations, 83, 85, 293-294, 304  
benefits of, 27-28, 203t  
common behaviors (of low literacy/understanding), 29-30  
electronic technology and websites, 31-32  
on goals of care, 253, 253t  
health literacy, 28-29, 36  
images/visuals, 34-36, 35  
increasing patient understanding, 30

Patient education (*continued*)  
by nurses, xxvi, 27, 303-304  
patient education materials, 32-35, 294, 304  
creating, 32-35  
plain language and clear designs, 33-34  
on postoperative gut function and oral intake, 216-217  
preoperative, importance of, 27-28  
red flags, 29-30  
teach-back method, 30  
Patient mobilization, 203t, 205, 251-256  
Patient-reported outcomes, 265, 270  
Patient's family/support system, 304  
Performance evaluation, 295-296, 320-330  
Peritoneal infiltration/catheters, 240t, 242  
Perphenazine, 112t  
Phenothiazines, 112t  
Photoplethysmograph, 158  
Physical activity, lack of, 89, 251-252.  
*See also Mobilization.*  
deconditioning and, 89, 251-252, 254  
Physical capacity, 82-83, 85  
exercise training/programs, 45, 46-49  
as measure of risk, 72-75  
optimizing prior to surgery, 40  
prehabilitation, 45-48, 82-83, 92-95, 102  
preoperative assessment of, 72-75  
Physical exercise, 92-95  
anaerobic threshold (AT) and risk, 47, 47t  
benefits of, 45, 90  
CPET and, 46-47, 48-49, 73-75, 74, 93  
exercise training/programs, 45, 46-49, 92-95, 102  
assessment and training design, 92-93  
example of, 93-95, 96t-97t  
heart rate reserve, 94, 96t, 98t  
intensity, classification of, 94, 98t  
maximal heart rate, 93-94  
synergic effect of program components, 94  
types of exercise, 93  
integration of nutrition and psychosocial balance with, 99,  
100, 102-103  
6MWT (6-minute walk test), 47-48, 72-73, 93, 257  
Physical therapy, 253

Physiologic challenges, perioperative, and their management, 202, 203t

Physiological function, 76-77

Pleth variability index (PVI), 133, 136, 140, 158

Polyethylene glycol (PEG), 59, 60t, 61, 63

PONV (postoperative nausea and vomiting), 105-106, 109

- antiemetic agents: choice, dosage, and timing, 112t-113t
- assessment of risk of, 105-106, 107
- flow chart for multimodal prevention, 110-111
- incidence of, 105
- proactive management of, 109
- reduction with intraoperative steroids, 131
- risk factors, 105, 107
- treatment strategies, 106, 108t, 110-111

POSSUM mortality models, 67, 69t-70t

Postoperative aspects, 215-276. See also *specific topics*.

- outcomes of ERPs, 263-276
- pain management, postoperative, 237-250
- patient mobilization and post discharge rehabilitation, 251-261
- postoperative oral nutrition and ileus prevention, 215-225
- tubes, drains, and catheter management, 227-235

Postoperative care, immediate, xxi-xxii, 218

Postoperative ileus (POI), 219-223, 220

- Duke approach, 223
- prevention of, 221-223, 316
- reduction with ERPs, 313-315

Postoperative mobilization, importance of, 78

Postoperative nausea and vomiting (PONV), 105-106, 107.

See also *PONV*.

Postoperative oral nutrition, 215-218

Postoperative pain. See *Pain management, postoperative*.

Pregabalin, 106, 117t, 118

Prehabilitation, 45-48, 82-83, 89-104, 251. See also *Functional capacity; Preoperative nutrition*.

- for abdominopelvic surgery, 89-104
- benefits of, 89-90, 91, 251
- clinical impact of, 90-91
- complications, postoperative, and, 89
- elements of, 91-100
- length of time for, 91
- preoperative health status and postoperative complications, 89

Prehabilitation (*continued*)

- anaerobic threshold (AT), 47, 47t
- CPET as guide for, 74, 93
- elements of, 91-100

  - exercise program/training, 92-95, 94, 96t-97t, 102
  - integration of elements, 99, 100, 102-103
  - interaction and effects on functional capacity, 100, 102-103
  - involving patients with, 100
  - medical optimization, 91, 102, 221
  - nutrition, 95-99, 102
  - psychological intervention, 99-100, 102

exercise training/programs, 46-49, 92-95

functional reserve and, 102

risk stratification, 47, 47t

6MWT (6-minute walk test), 47-48, 72-73, 93

Preoperative antiemetic and analgesic management, 105-120. See also *Analgesia; Antiemetic management*.

Preoperative aspects, xviii, 27-132. See also *specific topics*.

- assessment and optimization, 65-88
- bowel preparation, 53-64
- medical prophylaxis of postoperative complications, 121-132
- patient education, 27-38
- prehabilitation for abdominopelvic surgery, 89-104
- preoperative antiemetic and analgesic management, 105-120
- preoperative nutrition and prehabilitation, 39-52, 95-99

Preoperative assessment and optimization, 65-88

- cardiopulmonary and metabolic fitness, xviii
- functional capacity as a measure of risk, 72-75
- outcomes, fixed factors in, 65
- overview, xvii-xviii, 65, 84
- planning perioperative care based on, 65
- preoperative assessment, 65-67, 68t-71t, 85, 252-253, 253t

  - clinical acumen and routine tests, 65-66
  - clinical judgment, 66
  - history and mobility status, 252-253, 253t
  - risk stratification, 66-67, 68t-71t

preoperative optimization, 76-83, 89, 221

- anemia, 78-79, 85
- cardiovascular risk, 77
- diabetes, 80-81

Preoperative assessment and optimization, preoperative optimization (*continued*)  
education and conditioning of expectations, 83, 85, 293-294, 304  
hypertension, 77-78  
nutrition, 79-80, 95-99  
obesity, 80  
physiological function, 76-77  
prehabilitation, 82-83  
pulmonary risk, 78  
smoking and alcohol intake, 81, 85  
serological markers of risk, 75-76  
Preoperative education. See *Patient education*.  
Preoperative nutrition and prehabilitation, 39-52, 95-99.  
See also *Nutrition, preoperative*.  
detection of malnourished patients, 41, 42t-43t, 48  
immunonutrition, 44-45, 80, 99  
metabolic conditioning, 40  
nutritional supplementation, 40, 44, 79-80, 95-99, 130-131  
parenteral nutrition, 44  
prehabilitation, 45, 95-99  
preoperative fasting and carbohydrate loading, 39-40, 48, 61, 62, 202, 203t, 207-208, 221, 304-305  
surgical delay due to malnourishment, 44, 80  
treatment of malnourished patients, 44, 48  
tumor-related cachexia, 41  
Preoperative optimization. See *Preoperative assessment and optimization*.  
Preoperative pain management. See *Pain management, preoperative*.  
Preoperative prophylaxis of postoperative complications, 121-132  
anemia, 128-129, 129t  
antibiotic prophylaxis, 126-128, 126t, 127t, 190-191, 315  
diabetes management, 129-130  
perioperative corticosteroid management, 130-131  
VTE prophylaxis, 121-125, 122t-123t  
Preoperative surgical considerations, 190-191  
Promethazine, 112t  
Propofol, 108t, 248t

Protein  
metabolism, 206  
muscular protein synthesis, 99  
nutritional supplementation with, 95-99  
Protocols, 333, 334t-361t  
about, 333  
ASER anesthetic checklist, 360t-361t  
colorectal surgery pathway, 345t-351t  
Duke Enhanced Recovery distal pancreatectomy procedure, 352t-355t  
Duke Enhanced Recovery Whipple Procedure protocol, 356t-359t  
gyn-oncology surgery, 243t-244t  
liver resection, 337t-341t  
outcomes of, 263-276  
radical cystectomy, 334t-336t  
Pseudodiabetes of injury, 207  
*Pseudomonas*, 128  
Psychological intervention, 99-100, 102  
Psychology of change, 282, 290  
Pulmonary artery catheter (PAC), 151  
Pulmonary risk, 78  
Pulse oximeter waveform, 158  
  
Quality of life questionnaires, 100, 265  
  
Radiation therapy, exercise training and, 46  
Radical cystectomy  
analgesic regimens, 116t  
outcomes, 274  
protocol, 334t-336t  
Ramosetron, 112t  
Readmission, 264  
Rectus sheath blocks, 124  
Regional anesthesia, 165-176, 240t. See also *Anesthesia, regional*.  
Rehabilitation, post-discharge, 257-258  
Renal dysfunction, risks of perioperative, 78  
Renal responses to surgery, 209-210  
Risk, 66-83  
cardiovascular, 77  
functional capacity as measure of, 72-75

Risk (*continued*)

hypertension, 77-78  
mortality models, 67, 68t-71t  
nutritional, 42t-43t, 79  
predictive risk scores, 67, 68t-71t, 121  
pulmonary, 78  
renal dysfunction, 78  
risk stratification, 66-67, 68t-71t, 121  
serological markers of, 75-76  
surgical risk models, 67, 68t-71t  
Rogers, Everett, 297-298  
Ropivacaine, 117t, 238

Scopolamine, transdermal, 106, 113t

Scores: predictive risk scores, 67, 68t-71t

6MWT (6-minute walk test), 47-48, 72-73, 93, 257

Smoking, 81, 85

Spinal anesthesia, 173-174

risks, 166t, 173

Standardization of care, 278, 317

Statin therapy, 76, 77-78

Statistical process control charts, 325-327, 326

Steroids. See *Corticosteroids*.

Stress. See *Surgical stress response*.

Sufentanil, 239

Sulfonylureas, 81

Supplementation, nutritional, 40, 44, 79-80, 95-99, 130-131

Surgeons, xiii-xv, 293-300. See also *Team of caregivers*.

barriers and facilitators to implementation, 293-294

decision-making authority, 295

diffusion of practice, 297-298, 298

ERAS principles for, xiv-xv

“Golden Circle,” 296-297, 297

implementation role, xv, 293-296

leadership role, xiii, xiv-xv, 296-297

organizational design and, 294-296

overcoming challenges, 293-300

overview for, xiii-xv

patient follow-up with, 259

performance evaluation and, 295-296

team building, 296-298, 297

Surgical approaches and techniques, 189-197

automated scheduling for, 283-286, 286

communication, 190, 196

laparoscopic techniques, 189, 191-194, 217

lines and tubes, 194

minimally invasive approaches, 192, 196, 212, 217, 222

open surgical, 194

operative approaches, 191-194

outcomes, meta-analyses of, 272t

pain management, 195

patient positioning, 192

pre-existing access points, 192

pre-operative considerations, 190-191

robotic approaches, 193-194

Surgical Care Improvement Project (SCIP), 128

Surgical risk, 67, 68t-71t. See also *Risk*.

Surgical stress, comorbidities and, 65

Surgical stress response, 199-214

as beneficial or detrimental, 200

biphasic (ebb and flow) response, 199

defined, 199

ERAS and, 210-212, 211

insulin resistance and, 39, 207

intraoperative challenges, 204

key responses, 205-210

carbohydrate metabolism, 207-208

cardiovascular responses, 208-209

immunological responses, 208

mediators of, 205-206

metabolic responses, 206

protein metabolism, 206

renal responses, 209-210

mechanisms of, 200, 201, 205-206

perioperative physiologic challenges, and their

management, 202, 203t

postoperative challenges, 205

preoperative challenges, 202

reduction in, improved outcomes with, 200

tissue oxygen demand and, 73

Survival, improvement with ERAS, xiii

Sweetspot concept, 152, 154

System of care, 319-320

Systemic inflammatory response syndrome (SIRS), 75

- TAP blocks. See *Transverse abdominis plane (TAP) blocks*.
- Teach-back method, 30
- Team of caregivers, xiii-xiv, 174, 293, 296-298, 309  
communication within, 190, 196, 255
- Techniques, 189-197  
protocols, 333, 334t-361t  
surgical approaches and, 189-197
- Temperature, xix, 177-188. See also *Normothermia, maintaining*.  
core temperature/set point, 177-178, 180, 183  
hypothermia, 179-186, 180  
routes of heat transfer, 178, 178t
- Thoracic epidural anesthesia (TEA), 165-169, 174  
analgesia with, 108, 109, 114t, 116t, 118, 238-239  
anticoagulants, cautions for, 238-239  
benefits and concerns, 165-169, 166t  
cardiovascular benefits, 167  
gastrointestinal effects, 168  
pulmonary effects, 168  
enhanced recovery and, 168-169, 169  
as gold standard for open abdominopelvic surgery, 174  
in specific protocols, 108, 109, 114t, 116t, 118  
vs TAP blocks, 170-171, 174
- TPN (total parenteral nutrition), 44
- Tramadol, 115t, 117t, 118, 241t, 245, 249t
- Transfusion, blood, 79, 129, 203t, 204
- Transitional Model (Bridges), 280, 282
- Transverse abdominis plane (TAP) blocks, 170-172, 171, 172, 174  
analgesic effects of, 108, 118, 174, 194, 239, 240t, 314, 347t  
early mobilization postsurgery with, 124  
laparoscopic surgery and, 171-172  
side effects and complications, 239  
in specific procedures, 108, 118, 194, 347t  
training and equipment for, 287  
vs TEA, 170-171, 174
- TriLyte, 59, 60t
- Tropisetron, 113t
- Tubes, drains, and catheter management, 227-235  
abdominopelvic drains, 229-230, 233  
central venous access, 232-234  
nasogastric tubes, 228-229  
urinary catheters, 230-232, 233, 233t
- University of Virginia ERAS protocols, 61, 62
- Urinary catheters, 230-232, 233, 233t
- Urinary nitrogen, 206, 210
- Urinary tract infections, 231
- Urine output, 209-210, 231-232
- Urologic surgeries, outcomes, 274
- Vancomycin, 126t, 127t
- Venous thrombosis prophylaxis. See *VTE prophylaxis*.
- Ventilation techniques, xix
- VISION study, 76
- Vitamin A, 131
- Vitamin C, 129, 130
- Vomiting. See *PONV (postoperative nausea and vomiting)*.
- VTE prophylaxis, 121-125, 122t-123t  
chemoprophylaxis, 124-125  
dalteparin (Fragmin), 125  
enoxaparin (LVNX), 124-125  
fondaparinux (Arixtra), 125  
heparin, 124-125  
LMWH, 124-125  
subcutaneous (SC) heparin (SQH), 124-125  
early mobilization, 124  
extended prophylaxis, 125  
mechanical prophylaxis, 121-124, 122t-123t  
mortality from VTE, 124  
risk of bleeding and, 122t-123t, 125  
sequential compression devices, 121
- Websites, reliable, 31-32
- Whipple Procedure, 217, 218, 273, 356t-359t
- World Health Organization Disability Assessment Schedule (WHODAS), 265
- Wound infiltration, 118, 238, 240t, 242
- Zero balance strategy, 159, 160
- Zinc, 130
- Zosyn, 128