Rothman Institute Manual of
Total Joint Arthroplasty
Protocol-Based Care

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Dedication
Life brings us in contact with many. There are those we will remember forever. I dedicate this to those who have made an indelible mark in my life.

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Preface

Orthopedic surgery and the delivery of care to patients have entered a new era. The financial pressure on the healthcare has compelled us to examine the cost-effectiveness of our practices and care protocols. The easy access to information on the Internet has generated well-read and fairly informed patients. The various grading systems for the doctors and the hospitals, together with the satisfaction scores from patients have all led to a rush to change the manner in which we deliver care. The recent changes in healthcare reimbursements and introduction of “bundling” in the US have further compelled the medical community to seek strategies that will allow delivery of high quality and cost-effective care.

At our institution, we have been a believer in protocol-based care that allows efficient and cost-effective care. If these protocols are based on evidence, they provide further improvements in patient outcomes and serve to reduce cost. I am proud to present to you this book that summarizes many, if not all, the protocols that we have implemented at the Rothman Institute. The impetus behind writing this book is the numerous inquiries from colleagues and friends who have reached out to us asking for our protocols in various areas. We hope that having all of the institutional protocols will help our colleagues in the field to deliver greater care to their patients without having to reinvent the wheel. We realize that orthopedics is a fluid science, and many of these protocols will change in the future, if not changed by the time this book is printed. We will strive to keep the readers of this book informed of those changes by printing supplemental material in the future.

Javad Parvizi
The completion of this book would not be possible without the immense help of many whose names do not appear in the author list. We would like to thank Katherine Huff and Krystal Golankiewicz for proofreading the chapters. Special thanks to the nurses and other residents on the orthopedic service who provided insight to the authors during the preparation of the chapters to ensure that the protocols were accurately presented.
## Section 1: Preoperative

**Section Editors:** Scot Brown, Javad Parvizi

1. **Indications and Contraindications for Total Joint Arthroplasty**  
   Diana Bitar, James J. Purtill  
   3

2. **Preoperative Radiographic Evaluation**  
   Camilo Restrepo, William J. Hozack  
   11

3. **Consent: When and Where?**  
   Ryan Massimilla, Javad Parvizi  
   17

4. **Perioperative Patient Evaluation**  
   Eric H. Tischler, Gregory K. Deirmengian  
   23

5. **Additional Testing and Preoperative Consultation**  
   Julie L. Shaner, William J. Hozack, Philip Nimoityn  
   27

6. **Management of Preoperative Medications**  
   Corey T. Clyde, Scot Brown  
   37

7. **Prehabilitation for Total Knee Arthroplasty and Total Hip Arthroplasty**  
   Ripal P. Patel, Antonia F. Chen  
   49

8. **Clinical Examination of the Hip**  
   Priscilla Ku Cavanaugh, Javad Parvizi  
   53

9. **Clinical Examination of the Knee**  
   Priscilla Ku Cavanaugh, Javad Parvizi  
   57
10. **Preoperative Nutritional Optimization**  
   Pouya Alijanipour, Matthew S. Austin  
   63

11. **Smoking Cessation**  
   Pouya Alijanipour, Eric B. Smith  
   67

12. **Perioperative Optimization of the Diabetic Patient**  
   Pouya Alijanipour, Matthew S. Austin  
   71

13. **Optimization of the Patient with Cardiopathy**  
   T. David Tarity, James J. Purtill  
   75

14. **Optimization of the Renal Failure Patient**  
   Timothy L. Tan, Edward J. Filippone, Antonia F. Chen  
   81

15. **Optimization of Chronic Obstructive Pulmonary Disease**  
   T. David Tarity, James J. Purtill  
   85

16. **Optimization of Sleep Apnea**  
   Mohammad R. Rasouli, Javad Parvizi  
   89

17. **Optimization of Anemia**  
   Meng-Huang Wu, Javad Parvizi  
   95

18. **Preadmission Testing and Preoperative Consultation**  
   Julie L. Shaner, William J. Hozack, Philip Nimoityn  
   101

19. **Preoperative Templating**  
   Camilo Restrepo, Gregory K. Deirmengian  
   109

20. **Implant Selection for Total Hip Arthroplasty**  
   Reza Mostafavi Tabatabaee, Carl A. Deirmengian  
   123

21. **Implant Selection for Total Knee Arthroplasty**  
   T. David Tarity, Carl A. Deirmengian  
   135
## Section 2: Perioperative

**Section Editors:** Paul B. McKenna, Peter F. Sharkey

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>22.</td>
<td>Intraoperative Deep Vein Thrombosis Prophylaxis</td>
<td>143</td>
</tr>
<tr>
<td></td>
<td><em>Fatih Kucukdurmaz, William J. Hozack</em></td>
<td></td>
</tr>
<tr>
<td>23.</td>
<td>Multimodal Pain Management in Total Knee Arthroplasty</td>
<td>147</td>
</tr>
<tr>
<td></td>
<td><em>Priscilla Ku Cavanaugh, William J. Hozack</em></td>
<td></td>
</tr>
<tr>
<td>24.</td>
<td>Multimodal Pain Management in Total Hip Arthroplasty</td>
<td>155</td>
</tr>
<tr>
<td></td>
<td><em>Joshua J. Minori, William J. Hozack</em></td>
<td></td>
</tr>
<tr>
<td>25.</td>
<td>Peripheral and Neuraxial Blocks for Analgesia After Total Joint Arthroplasty: Indications and Techniques</td>
<td>163</td>
</tr>
<tr>
<td></td>
<td><em>Mohammad R. Rasouli, Eric S. Schwenk</em></td>
<td></td>
</tr>
<tr>
<td>26.</td>
<td>Preoperative Antibiotics</td>
<td>173</td>
</tr>
<tr>
<td></td>
<td><em>Antonia F. Chen, Javad Parvizi</em></td>
<td></td>
</tr>
<tr>
<td>27.</td>
<td>Tranexamic Acid</td>
<td>179</td>
</tr>
<tr>
<td></td>
<td><em>Mohammad R. Rasouli, Javad Parvizi</em></td>
<td></td>
</tr>
<tr>
<td>28.</td>
<td>Intraoperative Steroid Administration</td>
<td>187</td>
</tr>
<tr>
<td></td>
<td><em>Diana Bitar, Paul B. McKenna, Matthew S. Austin</em></td>
<td></td>
</tr>
<tr>
<td>29.</td>
<td>Anesthetic Techniques in Total Joint Arthroplasty: Neuraxial Anesthesia</td>
<td>191</td>
</tr>
<tr>
<td></td>
<td><em>Mohammad R. Rasouli, Suzanne Huffnagle, H. Jane Huffnagle</em></td>
<td></td>
</tr>
<tr>
<td>30.</td>
<td>Anesthetic Techniques in Total Joint Arthroplasty: General Anesthesia</td>
<td>197</td>
</tr>
<tr>
<td></td>
<td><em>Mohammad R. Rasouli, H. Jane Huffnagle, Suzanne Huffnagle</em></td>
<td></td>
</tr>
<tr>
<td>31.</td>
<td>Skin Preparation</td>
<td>203</td>
</tr>
<tr>
<td></td>
<td><em>Corey T. Clyde, Javad Parvizi</em></td>
<td></td>
</tr>
</tbody>
</table>
32. **Tourniquet Use in Total Knee Arthroplasty** 209  
Christina J. Gutowski, Peter F. Sharkey

33. **Operating Room Universal Precautions** 217  
Pouya Alijanipour, Eric B. Smith

34. **Surgical Hand Antisepsis Practices** 221  
Danielle Y. Ponzio, Antonia F. Chen

35. **Operating Room Traffic** 227  
Eric H. Tischler, Paul B. McKenna, Matthew S. Austin

36. **Draping** 233  
Pouya Alijanipour, Richard H. Rothman

37. **Approaches to the Hip: Direct Anterior** 237  
Reza Mostafavi Tabatabaee, Paul B. McKenna, William J. Hozack

38. **Approaches to the Hip: Direct Lateral** 243  
Fatih Kucukdurmaz, Paul B. McKenna, Richard H. Rothman

39. **Approaches to the Hip: Posterior** 249  
Christina J. Gutowski, Robert P. Good

40. **Medial Parapatellar Approach for Total Knee Arthroplasty** 255  
Paul B. McKenna, Peter F. Sharkey

41. **Subvastus and Midvastus Approach for Total Knee Arthroplasty** 261  
Seyedali R. Ghasemi, Jess H. Lonner

42. **Unicompartmental Knee Arthroplasty** 265  
Je-Hyun Yoo, Jess H. Lonner

43. **Patellofemoral Arthroplasty** 273  
T. David Tarity, Jess H. Lonner

44. **Total Hip Arthroplasty in Patients with Metabolic Bone Disease** 279  
T. David Tarity, William J. Hozack
45. Total Hip Arthroplasty in Protrusio Acetabuli  
   Reza Mostafavi Tabatabaee, Matthew S. Austin  
   283

46. Total Hip Arthroplasty in Patients with Proximal Femoral Deformity  
   Reza Mostafavi Tabatabaee, Matthew S. Austin  
   289

47. Total Knee Arthroplasty for Patients with Severe Deformity  
   Jorge Manrique, Fabio Orozco  
   295

48. Antibiotic Impregnated Cement  
   Christina J. Gutowski, Javad Parvizi  
   303

49. Computer-Assisted Total Knee Arthroplasty  
   Snir Heller, William J. Hozack  
   309

50. Patient-Specific Instrumentation  
   Reza Mostafavi Tabatabaee, Javad Parvizi  
   313

51. Management of Vascular Complications: Hip  
   Snir Heller, Peter F. Sharkey  
   317

52. Management of Vascular Complications: Knee  
   Diana Bitar, Paul B. McKenna, Peter F. Sharkey  
   321

53. Surgical Drains  
   Alisina Shahi, Richard H. Rothman  
   331

54. Wound Closure  
   Miguel M. Gomez, Zachary D. Post  
   337

55. Urinary Catheter in Primary Total Joint Arthroplasty  
   Priscilla Ku Cavanaugh, Alvin C. Ong  
   341

56. Surgical Dressing in Total Joint Arthroplasty  
   Eric H. Tischler, Peter F. Sharkey  
   345
57. Postoperative X-rays (Hips and Knees) 349
Camilo Restrepo, Alvin C. Ong

58. Heterotopic Ossification Prevention 357
Camilo Restrepo, Zachary D. Post

Section 3: Postoperative Management

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59. Operative Note Dictation in Total Joint Arthroplasty 363
Claudio Diaz-Ledezma, Javad Parvizi

60. Postoperative Fluid Management 369
Meng-Huang Wu, Javad Parvizi

61. Venous Thromboembolism Prophylaxis for Total Joint Arthroplasty 375
Timothy L. Tan, Richard H. Rothman

62. Risk Stratification for Venous Thromboembolism After Total Joint Arthroplasty 383
Maryam Rezapoor, Ronald Huang, Javad Parvizi

63. Sleeping Aids After Total Joint Arthroplasty 391
Brian T. Urbani, Fabio Orozco

64. Postoperative Gastrointestinal Complications 395
Danielle Y. Ponzio, Anthony J. DiMarino

65. Routine Postoperative Laboratory Investigations 401
Je-Hyun Yoo, Jess H. Lonner

66. Postoperative Antibiotic Prophylaxis 405
Danielle Y. Ponzio, Eric B. Smith
67. Wound Care and Dressings 411
   Snir Heller, James J. Purtill

68. Transfusions 415
   Danielle Y. Ponzio, Javad Parvizi

69. Fever Management 421
   Je-Hyun Yoo, Eric J. Levicoff

70. Oxygen Desaturation Management 427
    Jessica R. Viola, Antonia F. Chen, William J. Hozack

71. Altered Mental Status and Postoperative Neurologic Abnormalities 433
    David S. Casper, Michael F. Harrer

72. Weight-Bearing After Total Joint Arthroplasty 439
    Diana Bitar, Peter F. Sharkey

73. Management of Urinary Retention After Total Joint Arthroplasty 445
    Jenny Cai, Carl A. Deirmengian

74. Management of Cardiac Arrhythmias 449
    Snir Heller, Philip Nimoityn

75. Management of Diagnosed Deep Vein Thrombosis 455
    Geno J. Merli, Lynda J. Thomson

76. Management of Diagnosed Pulmonary Embolism 465
    Geno J. Merli, Lynda J. Thomson

77. Physical and Occupational Therapy After Total Knee Arthroplasty 473
    Joshua J. Minori, Kristen Vogl

78. Physical and Occupational Therapy After Total Hip Arthroplasty 479
    Joshua J. Minori, Kristen Vogl
79. **Discharge Destination:** Rehabilitation vs Home 485
   *Ryan Massimilla, Kristen Vogl*

80. **Home Physical Therapy After Total Joint Arthroplasty** 489
   *Jorge Manrique, Kristen Vogl*

81. **Discharge Pain Medications** 497
   *Joshua J. Minori, Eugene R. Viscusi*

82. **Activity Modification After Total Hip Arthroplasty** 503
   *Reza Mostafavi Tabatabaei, Richard H. Rothman*

83. **Continuous Passive Motion for Rehabilitation After Total Knee Arthroplasty** 509
   *Seyedali R. Ghasemi, Richard H. Rothman*

84. **Follow-Up Times and Goals After Total Joint Arthroplasty** 513
   *Ryan Massimilla, Fabio Orozco*

85. **Antibiotic Prophylaxis for Minor Procedures After Total Joint Arthroplasty** 517
   *Fatih Kucukdurmaz, Eric J. Levicoff*

86. **Restarting Medications** 523
   *Corey T. Clyde, Robert P. Good*

---

**Section 4 Complications**

*Section Editors: Antonia F. Chen, William J. Hozack*

87. **Management of Wound Drainage After Total Joint Arthroplasty** 533
   *Alisina Shahi, James J. Purtill*

88. **Postoperative Blister** 539
   *Snir Heller, William J. Hozack*
89. Postoperative Infection Investigation 543
   Benjamin Zmistowski, Javad Parvizi

90. Management of Acute Infection: Hip 549
   Benjamin Zmistowski, Antonia F. Chen

91. Management of Acute Infection: Knee 553
   Fatih Kucukdurmaz, Antonia F. Chen, Javad Parvizi

92. Management of Chronic Infection 559
   Benjamin Zmistowski, Antonia F. Chen

93. Management of Dislocated Hip: Early vs Late 567
   Diana Bitar, William J. Hozack

94. Management of Intraoperative Fractures During Total Hip Arthroplasty 579
   Alisina Shahi, James J. Purtill

95. Management of Intraoperative Fractures During Total Knee Arthroplasty 583
   Alisina Shahi, James J. Purtill

96. Management of Postoperative Periprosthetic Hip Fractures 589
   Diana Bitar, Gregory K. Deirmengian

97. Management of Postoperative Periprosthetic Knee Fractures 599
   Julie L. Shaner, Alvin C. Ong

98. Management of the Swollen Limb in the Early Postoperative Period 607
   Miguel M. Gomez, Zachary D. Post

99. Management of Residual Leg Length Discrepancy After Total Hip Arthroplasty 611
   Bryan A. Hozack, William J. Hozack
100. Management of Stiffness After Total Knee Arthroplasty 617
   Eric B. Smith, Jenny Cai

101. Management of Painful Total Knee Arthroplasty 621
   Benjamin Zmistowski, Peter F. Sharkey

102. Management of Neurologic Deficit: Hip 627
   T. David Tarity, Fabio Orozco

103. Management of Neurologic Deficit: Knee 633
   T. David Tarity, Fabio Orozco

Index 637
Clinical Examination of the Knee

Priscilla Ku Cavanaugh, Javad Parvizi

Rothman Protocol

All patients undergo a thorough medical history and knee examination. Clinical examination of the knee consists of inspection, palpation, motor testing, neurological testing, and in certain cases determined by the clinician, other special tests. The hip is also examined to rule out hip pathology as the culprit for symptomatology.

Knee Examination Algorithm

Inspection

Observe the patient walking and note the presence of a limp, asymmetry, gait or other abnormalities. Upon closer inspection, look for edema, discoloration, lacerations, scars, ecchymosis, muscle atrophy, or other abnormalities. Next, assess limb alignment with the patient standing making sure to note any genu varum, genu valgum, or genu recurvatum.

Palpation

Begin palpation of the knee joint by assessing its temperature, using the surrounding areas and contralateral leg for comparison. Infection or an acute knee injury may lead to a warm knee. Locate and palpate the tibial tuberosity, patella, and joint line. On both sides, palpate below the patella for swelling. Patellar subluxation should
be noted. Tenderness at the joint line may indicate intra-articular pathology such as arthritis. While moving the patient’s knee, feel for patellar tracking and crepitus. Crepitus indicates arthritis. Locate and palpate the medial and lateral meniscus noting any tenderness because it may indicate a tear. On the upper medial aspect of the tibia, locate the pes anserine bursa, palpate for any pain, effusion, or thickening. Assess stability of the collaterals by stabilizing the distal femur and applying varus and valgus stress to the tibia at full extension and with the knee flexed to 20°. Stability of the menisci and cruciates are tested by specific examinations (discussed in Table 9.3).

**Motor Assessment**
Evaluate the patient’s active and passive range of motion (Table 9.1).

**Neurocirculatory Assessment**
Assessment includes a pertinent vascular examination followed by sensory, muscle, and reflex testing.

**Vascular Examination**
Begin with the patient’s knee relaxed in flexion, palpate for the popliteal pulse located deep behind the knee. Next, distally palpate the dorsalis pedis and posterior tibialis

<table>
<thead>
<tr>
<th>Knee Exam</th>
<th>Patient Positioning</th>
<th>Normal ROM up to</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal/external rotation</td>
<td>Seated, femur stabilized, tibia rotated</td>
<td>10°</td>
</tr>
<tr>
<td>Flexion</td>
<td>Supine, knee bent, heel towards buttocks</td>
<td>135°</td>
</tr>
<tr>
<td>Extension</td>
<td>Supine, straighten knee from bent position</td>
<td>0°</td>
</tr>
</tbody>
</table>
bilaterally for strength and symmetry. Note that absence of hair or skin discoloration may signify poor circulation. If abnormalities are found and peripheral vascular disease (PVD) is suspected, ankle-brachial indexes (ABI) should be obtained using Doppler ultrasound. It is crucial to identify PVD patients, because PVD is a relative contraindication to total knee arthroplasty. An ABI of 0.9–1.3 is considered normal; if less than 0.9, the patient may have elevated risk of arterial complications and should be referred to a vascular surgeon. An ABI less than 0.5 indicates severe ischemia and an angiogram is recommended.

**Sensation Testing**
Test sensation in dermatomal distribution and assess the different sensory modalities: temperature, sharp touch, light touch, vibration, and proprioception.

**Muscle Testing**
Bilaterally assess power of muscle groups, using the contralateral limb for comparison. Maneuvers are shown in Table 9.2.

**Reflex Testing**
Both the patellar reflex (L2, 3, 4) and ankle reflex (S1) should be assessed bilaterally.

**Other Common/Special Tests**
Additional individual knee components are tested with other specific tests. Maneuvers for key tests are described in Table 9.3.

**Table 9.2.** Muscle examination components for the knee

<table>
<thead>
<tr>
<th>Exam</th>
<th>Muscles Involved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extension</td>
<td>Primary: quadriceps femoris</td>
</tr>
<tr>
<td>Flexion</td>
<td>Primary: Hamstring muscles (biceps femoris, semitendinosus, semimembranosus)</td>
</tr>
<tr>
<td>Exam</td>
<td>Positive Test</td>
</tr>
<tr>
<td>------</td>
<td>---------------</td>
</tr>
<tr>
<td>Patellar instability</td>
<td>(a) Patella subluxation</td>
</tr>
<tr>
<td></td>
<td>(b) Inverted J-shaped motion of patella</td>
</tr>
<tr>
<td></td>
<td>(a) Seated patient supports lower leg, place your thumb on lateral femoral epicondyle as you laterally push the medial side of patella</td>
</tr>
<tr>
<td></td>
<td>(b) Seated patient, flexes and extends knee</td>
</tr>
<tr>
<td>Medial collateral ligament (MCL)</td>
<td>Supine patient, secure the ankle and push medially against knee and laterally against ipsilateral ankle</td>
</tr>
<tr>
<td></td>
<td>Supine patient, secure the ankle and push medially against knee and laterally against ipsilateral ankle</td>
</tr>
<tr>
<td>Lateral collateral ligament (LCL)</td>
<td>Supine patient with knee 90° flexed, slide proximal tibia anteriorly (a) or posteriorly (b); compare to uninjured knee</td>
</tr>
<tr>
<td></td>
<td>Supine patient, secure the ankle and push medially against ipsilateral ankle</td>
</tr>
</tbody>
</table>

Table 9.3. Knee examination tests
<table>
<thead>
<tr>
<th><strong>Lachman</strong></th>
<th>Supine patient with knee flexed 20°–30°, anterior force applied to proximal tibia</th>
<th>Laxity of tibia, tibia pulled forward</th>
<th>ACL deficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pivot shift</strong></td>
<td>Supine patient, knee extended, IR, apply valgus force and flex knee</td>
<td>Lateral tibial plateau shifts posteriorly</td>
<td>ACL deficiency</td>
</tr>
<tr>
<td><strong>McMurray</strong></td>
<td>Supine patient, flexed hip and knee, palpate lateral joint space, and with other hand alternate between IR and ER of foot</td>
<td>Pain (with meniscal snap or crepitus)</td>
<td>Medial or lateral meniscal tear/lesion</td>
</tr>
<tr>
<td><strong>Squat test</strong></td>
<td>Squats by patient, feet and legs alternating between internal and external rotation for each squat</td>
<td>(a) Medial pain (b) Lateral pain</td>
<td>(a) Lateral meniscal tear (b) Medial meniscal tear</td>
</tr>
</tbody>
</table>
References


