



Adult Reconstruction Fellowship Guidelines

Approved March 2022 by AAHKS, THS, and TKS.

Suggested Reading: OTHER TOPICS

1) Statistics: Interpreting Literature

1. MGH Institute page for resources for critical appraisal of literature e.g. basic statistics, how to critically evaluate literature. <https://libguides.massgeneral.org/ArticleEval>
2. Krousel-Wood MA, Chambers RB, Muntner P. Clinicians' guide to statistics for medical practice and research: part I. Ochsner J. 2006;6(2):68-83.
3. Krousel-Wood MA, Chambers RB, Muntner P. Clinicians' Guide to Statistics for Medical Practice and Research: Part II. Ochsner J. 2007;7(1):3-7.

2) Billing and Coding

1. Journal of Arthroplasty May 2016 31(5) 945-946 PMID 27026645
Importance of proper utilization of ICD-10 Revision and clinical documentation in modern payment models
2. <https://www.aaos.org/aaosnow/2021/may/managing/managing01/>
3. <https://www.aahks.org/wp-content/uploads/2018/08/ICD10-EZ-sheet-hip-arthroplasty.pdf>
4. <https://www.aahks.org/wp-content/uploads/2018/08/ICD10-EZ-sheet-knee-arthroplasty.pdf>
5. <https://www.aaos.org/aaosnow/2020/apr/managing/managing01/>

3) Preoperative Optimization

1. Arthroplasty 1,4 (2019) Reducing the risk of infection after total joint arthroplasty: Preoperative optimization
<https://arthroplasty.biomedcentral.com/articles/10.1186/s42836-019-0003-7>
2. Journal of Arthroplasty Aug 2016 31(8) 1631-1634 PMID 27118349
Patient Optimization, Strategies that work: Malnutrition
3. Bone and Joint Journal Jan 2019 Vol 101- B No 1 -Supplement
The prevention of infection 12 modifiable risk factors



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4) Pain Management (credit: Christopher Anthony, MD)

1. Bedard NA, Pugely AJ, Westermann RW, Duchman KR, Glass NA, Callaghan JJ. Opioid Use After Total Knee Arthroplasty: Trends and Risk Factors for Prolonged Use. *J Arthroplasty*. 2017 Aug;32(8):2390-2394. doi: 10.1016/j.arth.2017.03.014. Epub 2017 Mar 16. PMID: 28413136.

This study found that preoperative opioid use was the strongest predictor for prolonged postoperative opioid use after TKA.

2. Shah R, Kuo Y, Westra J, Lin Y, Raji MA. Opioid Use and Pain Control After Total Hip and Knee Arthroplasty in the US, 2014 to 2017. *JAMA Netw Open*. 2020;3(7):e2011972. doi:10.1001/jamanetworkopen.2020.11972

This study found that while morphine milligram equivalent dose after TKA and THA decreased from 2015 to 2017, the percentages of patients receiving opioids increased after THA or TKA, without improved postoperative pain control.

3. *Orthop Surg*. 2019 Oct;11(5):755-761. Postoperative Pain Management in Total Knee Arthroplasty. [Jing-Wen Li](#), [Ye-Shuo Ma](#), [Liang-Kun Xiao](#)

This article reviews 67 studies on various modalities of pain control after total knee arthroplasty, including preemptive analgesia, neuraxial anesthesia, peripheral nerve blockade, patient-controlled analgesia and local infiltration analgesia, and oral opioid/nonopioid medications.

4. *Pain*. 2015 Jan;156(1):8-30. Postoperative pain treatment after total hip arthroplasty: a systematic review. [Anders Peder Højer Karlsen](#), [Anja Geisler](#), [Pernille Lykke Petersen](#), [Ole Mathiesen](#), [Jørgen B Dahl](#).

This meta-analysis covers the efficacy and side effects of various pain management strategies for THA.

5. *Orthop Clin North Am*. 2017 Oct;48(4):407-419. Perioperative Pain Management in Hip and Knee Arthroplasty. [Christian J Gaffney](#), [Christopher E Pelt](#), [Jeremy M Gililand](#), [Christopher L Peters](#).

This article reviews multimodal pain management for hip and knee arthroplasty.



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Suggested Reading: OTHER TOPICS

5) VTE Prophylaxis

1. Orthopedic Knowledge Update 5, Chapter 2: Perioperative Assessment and Management.
2. JAAOS. 2019 Dec 1;27(23):878-886 PMID: 31259844
3. JBJS. 2019 Apr 3;101(7):589-599. PMID: 30946192
4. JAAOS. 2017 Dec;25(12):789-798. PMID: 29176502
5. <https://www.aaos.org/quality/quality-programs/tumor-infection-and-military-medicine-programs/venous-thromboembolic-disease-in-elective-tka-and-tha-prevention/>

6) Anesthesia and Total Joint Replacement

1. OKU 5 Chap 2: Perioperative Management and Assessment; Section on Anesthesia Options (Page 19)
Yellow Journal Review Article from 2016 on current anesthesia strategies
2. Current Strategies in Anesthesia and Analgesia for Total Knee Arthroplasty (PMID 26803543)
JOA Meta-analysis on the use of TXA
3. The Efficacy of Tranexamic Acid in Total Hip Arthroplasty: A Network Meta-analysis (PMID 30007789)
3. JBJS Articles comparing the 30 day outcomes and surgical complications in spinal vs general anesthesia in TKA
4. Differences in Short-Term Complications Between Spinal and General Anesthesia for Primary Total Knee Arthroplasty (PMID: 23269359)
JOA review article going over the opioid epidemic. Appendix with excellent Protocol
5. The Opioid Crisis and the Orthopedic Surgeon (PMID 30075877)



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7) Blood Conservation

1. Hooper, J., & Schwarzkopf, R. (2017). Additional Tools to Prevent Blood Loss in Total Joint Arthroplasty. *Techniques in Orthopaedics*, 32(1), 34–40. doi:10.1097/bto.0000000000000207
2. Ramkumar, D. B., Ramkumar, N., Tapp, S. J., & Moschetti, W. E. (2018). Pharmacologic Hemostatic Agents in Total Joint Arthroplasty—A Cost-Effectiveness Analysis. *The Journal of Arthroplasty*, 33(7), 2092–2099.e9. doi:10.1016/j.arth.2018.02.068
3. Fillingham, Y. A., Ramkumar, D. B., Jevsevar, D. S., Yates, A. J., Shores, P., Mullen, K., ... Della Valle, C. J. (2018). The Safety of Tranexamic Acid in Total Joint Arthroplasty: A Direct Meta-Analysis. *The Journal of Arthroplasty*. doi:10.1016/j.arth.2018.03.031
4. Boese, C. K., Centeno, L., & Walters, R. W. (2017). Blood Conservation Using Tranexamic Acid Is Not Superior to Epsilon-Aminocaproic Acid After Total Knee Arthroplasty. *The Journal of Bone and Joint Surgery*, 99(19), 1621–1628. doi:10.2106/jbjs.16.00738



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8) PT After Joint Replacement

1. Orthopedic Knowledge Update 5, Chapter 22: Perioperative Pain Management in Knee Arthroplasty. Pages 282-283.
2. Orthopedic Knowledge Update 5, Chapter 33: Rapid Recovery in Total hip arthroplasty. Patient Education and Preoperative Rehabilitation, Pages 438-439. Rehabilitation and Preparation for Discharge, Page 443.
3. Moyer R, Ikert K, Long K, Marsh J. The Value of Preoperative Exercise and Education for Patients Undergoing Total Hip and Knee Arthroplasty: A Systematic Review and Meta-Analysis. JBJS Rev 2017;5:e2.
<https://doi.org/10.2106/JBJS.RVW.17.00015>.

A systematic review of patients undergoing preoperative rehab and education prior to TKA showed significant improvements were observed in function, quadriceps strength, and length of stay. In patients undergoing THA, significant improvements were observed in pain, function, and length of stay. Included studies were inconsistent with regard to the types of outcome measures reported, and the quality of the interventions varied.

4. Fortier LM, Rockov ZA, Chen AF, Rajae SS. Activity Recommendations After Total Hip and Total Knee Arthroplasty. J Bone Joint Surg Am 2021;103:446–55. <https://doi.org/10.2106/JBJS.20.00983>.

Current concepts review shows that for TKA patients, supervised telerehabilitation has also been proven to be an effective modality, with studies suggesting equivalent efficacy compared with supervised in-person PT. A formal unsupervised activity program should be recommended to all patients recovering from total knee arthroplasty (TKA) and total hip arthroplasty (THA). Despite traditional postoperative protocols recommending range-of-motion restrictions after THA, it is reasonable to recommend that hip precautions may not be needed routinely following elective primary THA.

5. Bohl DD, Li J, Calkins TE, Darrith B, Edmiston TA, Nam D, et al. Physical Therapy on Postoperative Day Zero Following Total Knee Arthroplasty: A Randomized, Controlled Trial of 394 Patients. J Arthroplasty 2019;34:S173-S177.e1.
<https://doi.org/10.1016/j.arth.2019.02.010>.

This randomized trial did not demonstrate clinically meaningful differences in hospital LOS or patient satisfaction when PT is initiated on the day of surgery vs on the morning after surgery.

6. Austin MS, Urbani BT, Fleischman AN, Fernando ND, Purtill JJ, Hozack WJ, et al. Formal Physical Therapy After Total Hip Arthroplasty Is Not Required: A Randomized Controlled Trial. J Bone Joint Surg Am 2017;99:648–55.
<https://doi.org/10.2106/JBJS.16.00674>.

This randomized trial suggests that unsupervised home exercise is both safe and efficacious for a majority of patients undergoing total hip arthroplasty, and formal physical therapy may not be required.

7. Videos:

- Knee PT, Adolph Lombardi, MD
<https://www.vumedi.com/video/physical-therapy/>
- PT necessary after hip and knee arthroplasty, David Markel, MD
<https://www.vumedi.com/video/is-formal-postoperative-physical-therapy-mandatory-following-hip-and-knee-arthroplasty/>



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9) Incision Management

1. Orthopedic Knowledge Update 5, Chapter 15: *Infection*
2. Orthopedic Knowledge Update 5, Chapter 18: *Anatomy and Surgical Approaches to Knee Arthroplasty*
3. Advanced Reconstruction Hip 2, Chapter 3: *The Modern Posterior Approach*
4. Kim JH, Kim HJ, Lee DH. Comparison of the Efficacy Between Closed Incisional Negative-Pressure Wound Therapy and Conventional Wound Management After Total Hip and Knee Arthroplasties: A Systematic Review and Meta-Analysis. *J Arthroplasty*. 2019 Nov;34(11):2804-2814. doi: 10.1016/j.arth.2019.06.020. Epub 2019 Jun 19. PMID: 31288945.

This study evaluated the effect of closed incisional negative-pressure wound therapy (ciNPWT) on wound complications, skin blisters, surgical site infections (SSIs), reoperations, and length of hospitalization (LOH). Although skin blisters were more likely to develop in ciNPWT, the risks of wound complication, SSI, reoperation, and longer LOH decreased in ciNPWT compared with those in conventional dressings.

5. Siqueira MB, Ramanathan D, Klika AK, Higuera CA, Barsoum WK. Role of negative pressure wound therapy in total hip and knee arthroplasty. *World J Orthop*. 2016 Jan 18;7(1):30-7. doi: 10.5312/wjo.v7.i1.30. PMID: 26807353; PMCID: PMC4716568.

Due to the devastating consequences of infection in the setting of joint arthroplasty, there has been some interest in the use of NPWT following total hip arthroplasty and total knee arthroplasty. The prophylactic use of NPWT after arthroplasty in patients that are at high risk for postoperative wound drainage appears to have the strongest clinical evidence. Several clinical trials including single-use NPWT devices for this purpose are currently in progress and this may soon be incorporated in clinical guidelines as a mean to prevent periprosthetic joint infections.

6. Jahng KH, Bas MA, Rodriguez JA, Cooper HJ. Risk Factors for Wound Complications After Direct Anterior Approach Hip Arthroplasty. *J Arthroplasty*. 2016 Nov;31(11):2583-2587. doi: 10.1016/j.arth.2016.04.030. Epub 2016 May 6.

PMID: 27267230. Retrospective case-control study of 651 consecutive DAA hip arthroplasty surgeries performed by 2 surgeons over a 3-year period. Outcome measures included any postoperative wound problem (including prolonged drainage, wound dehiscence, wound necrosis, suture granuloma, and superficial infection) requiring additional intervention or reoperation. They concluded that obesity and diabetes mellitus are significantly associated with postoperative wound-healing complications and the need for reoperation for these wound complications after DAA hip arthroplasty.

7. Videos:

- *Addressing Wound Management in Total Joint Arthroplasty*. Presented by Javad Parvizi, Michael Bolognesi, Bryan Springer and Yale Fillingham. December 21, 2020.
<https://www.vumedi.com/video/addressing-wound-management-in-total-joint-arthroplasty/>
- *Optimizing Wound Management and Minimize Infection Risk*. Presented by Alexander Sah. California Orthopedic Association. November 9, 2017.
<https://www.vumedi.com/video/working-lunch-mitigating-the-risk-of-infection-following-total-joint-arthroplasty/>
- *Advances in Post Operative Wound Management: Optimizing the Surgical Site*. Presented by Bryan Springer. January 26, 2018.
<https://www.vumedi.com/video/advances-in-post-operative-wound-management-optimizing-the-surgical-site/>



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10) Contracts; Medical Malpractice

1. J Bone Joint Surg Am. 2012. PMID: 22552681
2. J Bone Joint Surg Am. 2018 Jun 6;100(11):e78. PMID: 29870452
3. J Bone Joint Surg Am. 2019 Oct 16;101(20):1806-1811. PMID: 31626004

11) Outpatient Arthroplasty

1. Orthopedic Knowledge Update 5, Chapter 2: Perioperative Assessment and Management
2. Orthopedic Knowledge Update 5, Chapter 19: Outpatient Total Knee Arthroplasty
3. Orthopedic Knowledge Update 5, Chapter 22: Perioperative Pain Management in Knee Arthroplasty
4. JOA. 2020 Jul;35(7):1941-1949 PMID: 32192837
5. JOA. 2020 Jul ;S0883-5403(20) 30778-6 PMID: 32778415
6. JOA. 2020 Jul 30;S0883-5403(20) 30855-X PMID: 32839058
7. JOA. 2020 Sep;35(9):2451-2457. PMID 32423759
8. JAAOS. 2020 Aug 18. PMID: 32826663

12) Work Hazards of the Orthopedic Surgeon; Crew Training; Ethics

1. Adult Reconstructive Surgery: A High-Risk Profession for Work-Related Injuries (PMID: 26791046)
2. Dedicated Orthopedic Operating Room Unit Improves Operating Room Efficiency (PMID: 23540542)
3. Overlapping Surgery Increases Operating Room Efficiency Without Adversely Affecting Outcomes in Total Hip and Knee Arthroplasty (PMID: 32081499)
4. Ethics of Total Joint Arthroplasty Gainsharing (PMID 28244921)



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13) Value-based Care; Bundles

Credit: Eric Smith, MD

1. Economics and Cost Implications of Total Hip and Total Knee Arthroplasty. OKU 5. Pages 63-72 AAOS 2017. Richard Iorio, MD Feroz Osmani, BS Savyasachi Thakkar, MD

In this review chapter, the concepts of cost analysis, cost reduction and payment methods are introduced. The economic burden of short and long-term revision TJA is discussed

2. Value-based Total Hip and Knee Arthroplasty: A Framework for Understanding the Literature. Schwartz, Adam J. MD, MBA; Bozic, Kevin J. MD, MBA; Etzioni, David A. MD Journal of the American Academy of Orthopaedic Surgeons: January 01, 2019 - Volume 27 - Issue 1 - p 1-11

The purpose of this review was to provide a framework for understanding the rapidly growing quality and cost literature. In this review quality improvement is addressed in relation to the structure, process, and outcomes of total joint arthroplasty. Cost savings are evaluated in the context of existing accounting methods, relationships to the entire cycle of osteoarthritis care, and the direct effect on the quality of care provided.

3. Kiridly DN, Karkenny AJ, Hutzler LH, Slover JD, Iorio R, Bosco JA III: The effect of severity of disease on cost burden of 30-day readmissions following total joint arthroplasty (TJA). J Arthroplasty 2014;29(8):1545-1547.

The cost of TJA as well as all additional related medical costs for up to 90 days are bundled into one lump sum. In this study, 2,026 patients undergoing TJA were reviewed to analyze costs of readmission and readmission rate. Both increased as the severity of illness increased.

4. Quality Measures in Total Hip and Total Knee Arthroplasty. Amanatullah, Derek F. MD, PhD; McQuillan, Thomas MD; Kamal, Robin N. MD Journal of the American Academy of Orthopaedic Surgeons: March 15, 2019 - Volume 27 - Issue 6 - p 219-226.

Various stakeholders have developed quality measures in total joint arthroplasty, with increasing focus on developing outcome measures. The results of this review inform orthopaedic surgeons on quality measures that payers could use value-based payment models like the Merit-based Incentive Payment System and Comprehensive Care for Joint Replacement.

5. The Cost of Hip and Knee Revision Arthroplasty by Diagnosis-Related Groups: Comparing Time-Driven Activity-Based Costing and Traditional Accounting. Christopher J Fang , Jonathan M Shaker , Jacob M Drew , Andrew Jawa , David A Mattingly , Eric L Smith

Traditional hospital cost accounting (TA) has innate disadvantages that limit the ability to meaningfully measure care pathways and quality improvement. Time-driven activity-based TDABC for revision TJA provides valuable bottom-up information on cost centers in the care pathway and, with targeted interventions, may lead to a more optimal delivery of value-based health care.