

ANESTHESIA FOR TOTAL JOINT REPLACEMENT SURGERY

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DISCLOSURES

- No financial disclosures or conflicts of interest
- Will discuss several off-label uses of medications

OBJECTIVES

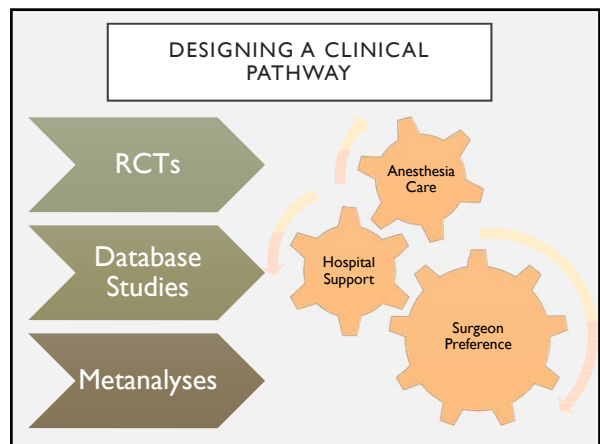
- Discuss clinical pathways for joint surgery
- Discuss evidence for choice of anesthesia
- Discuss multimodal analgesia and regional anesthesia options for joint replacement surgery.
- Discuss elements of Early Recovery After Surgery (ERAS) programs for joint replacement surgery.

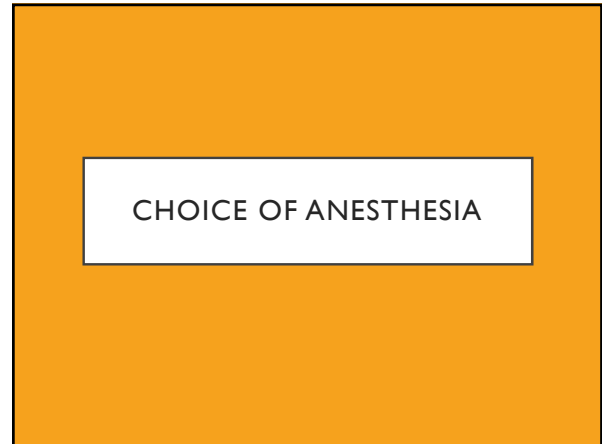
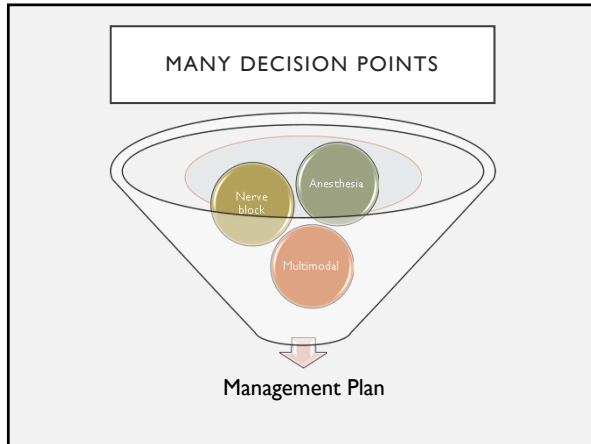
TOTAL JOINT REPLACEMENT

- Over 700,000 TKA and THA procedures annually in the US
- Demand expected to quadruple by 2030

GOALS OF A CLINICAL PATHWAY

| | |
|---|-------------------------|
| ● | Pain |
| ● | Morbidity |
| ● | Cost |
| ● | Length of Stay |
| ● | Falls |
| ● | Blood transfusion |
| ● | Use of Resources |
| ● | Surgical Site Infection |
| ● | Functional Outcomes |





SYSTEMATIC REVIEW: TKA & THA PTS

REVIEW ARTICLES

Neuraxial vs general anaesthesia for total hip and total knee arthroplasty: a systematic review of comparative-effectiveness research

R. L. Johnson*, S. L. Kopp, C. M. Burkle, C. M. Duncan, A. K. Jacob, P. J. Erwin, M. H. Murad and C. B. Mantilla

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Abstract

Background: This systematic review evaluated the evidence comparing patient-important outcomes in spinal or epidural vs general anaesthesia for total hip and total knee arthroplasty.

Methods: MEDLINE, Cochrane CENTRAL, Thomson Reuters Web of Science, and the Cochrane Central Register of Controlled Trials from inception until March 2015 were searched. Eligible randomized controlled trials or prospective comparative studies investigating mortality, major morbidity, and patient experience outcomes directly comparing neuraxial (spinal or epidural) with general anaesthesia for total hip arthroplasty, total knee arthroplasty, or both were included. Independent reviewers working in duplicate extracted study characteristics, validity, and outcomes data. Meta-analysis was conducted using the random-effects model.

Johnson, R. L., et al. (2016). Br J Anaesth 116(2): 163-176.

LARGE DATABASE TKA STUDY: SA VS. GA

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Differences in Short-Term Complications Between Spinal and General Anesthesia for Primary Total Knee Arthroplasty

Andrew J. Pugely, MD, Christopher T. Martin, MD, Yubo Gao, PhD, Sergio Mendosa-Lattes, MD, and John J. Callaghan, MD
Investigation performed at the University of Iowa Hospitals and Clinics, Iowa City, Iowa

Background: Spinal anesthesia has been associated with lower postoperative rates of deep-vein thrombosis, a shorter operative time, and less blood loss when compared with general anesthesia. The purpose of the present study was to identify differences in thirty-day perioperative morbidity and mortality between anesthesia choices among patients undergoing total knee arthroplasty.

Methods: The American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) database was searched to identify patients who underwent primary total knee arthroplasty between 2005 and 2010. Complications that occurred within thirty days after the procedure in patients who had been managed with either general or spinal anesthesia

Pugely, A. J., et al. (2013). J Bone Joint Surg Am 95(3): 193-199.

LARGE DATABASE TKA STUDY: SA VS. GA

Results (unadjusted, all p < 0.01)

Overall complication rate:

- SA 10.72% vs GA 12.34%

Superficial wound infection:

- SA 0.68% vs GA 0.92%

Blood transfusion:

- SA 5.02% vs GA 6.07%

Duration of hospital stay:

- SA 3.45d vs GA 3.77d

After logistic regression

Independent risk factors for complications (all p < 0.05):

- Age 70-79y: OR 1.531
- Age > 80y: OR 2.173
- Female vs male sex: OR 1.176
- Black vs white race: OR 1.678
- Serum Cr > 1.2 mg/dL: OR 1.474
- ASA class 3 or 4: OR 1.204
- General vs spinal anesthesia: OR 1.129

After stratification

Pts in quintile 5 (20% with highest probability of complications):

- SA 11.63% vs GA 15.28% (p=0.015)

LARGE DATABASE THA STUDY: RA VS. GA

Effects of Regional Versus General Anesthesia on Outcomes After Total Hip Arthroplasty

A Retrospective Propensity-Matched Cohort Study

Mohammad A. Helwani, MD, Michael S. Avidan, MBBCh, Arbi Ben Abdallah, PhD, Dagmar J. Kaiser, MD, John C. Clohiesy, MD, Bruce L. Hall, MD, and Heiko A. Kaiser, MD
Investigation performed at the Washington University in St. Louis School of Medicine, St. Louis, Missouri

Background: Many orthopaedic surgical procedures can be performed with either regional or general anesthesia. We hypothesized that total hip arthroplasty with regional anesthesia is associated with less postoperative morbidity and mortality than total hip arthroplasty with general anesthesia.

Methods: This retrospective propensity-matched cohort study utilizing the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) database included patients who had undergone total hip arthroplasty from 2007 through 2011. After matching, logistic regression was used to determine the association between the type of anesthesia and deep surgical site infections, hospital length of stay, thirty-day mortality, and cardiovascular and pulmonary complications.

Results: Of 12,929 surgical procedures, 5103 (39.5%) were performed with regional anesthesia. The adjusted odds for

Helwani, M. A., et al. (2015). J Bone Joint Surg Am 97(2): 186-193.

LARGE DATABASE THA STUDY: RA VS. GA

Results (after matching with controls): RA vs GA

- Deep infection: 0.22% vs 0.57%; OR 0.38 (p < 0.01)
Independently assoc. factors: Revision THA, age > 70y & IDDM
- CV complications: 0.9% vs 1.4%; OR 0.61 (p < 0.01)
- Pulm. complications: 0.5% vs 0.9%; OR 0.51 (p < 0.01)
- Average hospital LOS: 3.2 vs 3.4 days (p < 0.01)
- Prolonged hospital LOS: 5% vs 6.6%; OR 0.75 (p < 0.01)
- 30-day mortality: 0.29% vs 0.37% - NOT statistically significant
Independently assoc. factors: Revision THA, age > 70y, ASA class 3 or 4, IDDM

RCT OF TKA PROTOCOL:
TIVA VS SAB

British Journal of Anaesthesia 113 (3): 391-9 (2013)
Advance Access publication: 11 April 2013 - doi:10.1093/bja/aet104

BJA

Recovery after total intravenous general anaesthesia or spinal anaesthesia for total knee arthroplasty: a randomized trial[†]

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Editor's key points

- Regional anaesthesia is often recommended for total knee arthroplasty (TKA).

Background. This study was undertaken to compare the effects of general anaesthesia (GA) and spinal anaesthesia (SA) on the need for postoperative analgesia and early postoperative comfort in patients undergoing fast-track total knee arthroplasty (TKA).
Methods. One hundred and twenty subjects were randomly allocated to receive either intrathecal bupivacaine (SA group) or GA with target-controlled infusion of propofol and remifentanyl (GA group). Primary outcome was length of hospital stay (LOS) defined as

Harsten, A. et al. (2013), *Br J Anaesth* 111(3): 391-399

RCT OF TKA PROTOCOL:
TIVA VS SAB

- RCT comparing GA (target-controlled infusion of propofol plus remifentanyl) vs SA (intrathecal bupivacaine) for TKA in a fast-track setting.
- Design:
 - N = 120 pts
 - ASA class 1-3
 - Age 45-85y
- Exclusions: revision TKA, BMI > 35, rheumatoid arthritis, immunodepression, allergy to study drugs, preop opioids or steroids, hx of stroke or psych disease that could affect the perception of pain
- Measures:
 - Primary = hospital length of stay
 - Secondary = Actual discharge time, postoperative pain, intraop blood loss, PACU LOS, dizziness, PONV, need for urinary catheterization, patient satisfaction

RCT OF TKA PROTOCOL:
TIVA VS SAB

- | | |
|---|---|
| <p>Preop:</p> <ul style="list-style-type: none"> • Celecoxib 400mg PO, • APAP 1g PO <p>Intraop:</p> <ul style="list-style-type: none"> • No tourniquet or drains • Tranexamic acid 1g IV; abx prophylaxis; 2L LR over first 24h • High-volume LIA: Ropiv 0.2% 150mL w epi 10mcg/mL • Posterior capsule, periarticular, and anterior peri-incisional subcutaneous tissues <p>Postop:</p> <ul style="list-style-type: none"> • Celecoxib 400mg PO q 12h, APAP 1g PO q6h • IV PCA morphine for 24h at 20mcg/kg 10 min lockout • After 24h, oxySR 10mg q12h and oxyIR 10mg prn • Q3h bladder scans with bladder catheterization protocol | <p>Randomized to two groups</p> <p>SA group:</p> <ul style="list-style-type: none"> • Bupivacaine 0.5% 3mL intrathecal at L4-5 • Propofol gtt for light sedation with 2L NC O2 <p>GA group:</p> <ul style="list-style-type: none"> • Propofol target-controlled infusion (TCI) 10mg/mL plus remifentanyl 40mcg/mL • Rocuronium 0.6mg/kg for intubation • Neostigmine 2.5mg plus glycopyrrolate 0.5mg for NMB reversal • Oxycodone 10mg IV 20 min before end of surgery |
|---|---|

RCT OF TKA PROTOCOL: TIVA VS SAB

Results: (p < 0.05)

- No difference in subject characteristics or surgical data
- Hospital LOS: GA vs SA
 - 46h vs 52h
- Lower initial pain scores in SA group, but after 6h lower pain scores were seen in GA group
- 24h morphine consumption: GA vs SA
 - 19mg vs 54mg
- Rates of dizziness, ability to walk 5m at 6h & 10h, and need for bladder catheterization showed benefit in the GA group.
- No difference in PE, blood loss or patient satisfaction

RCT OF THA PROTOCOL: TIVA VS SAB

Total intravenous general anaesthesia vs. spinal anaesthesia for total hip arthroplasty: a randomised, controlled trial

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³Department of Surgical Pathophysiology, Rigshospitalet, Copenhagen University, Copenhagen, Denmark
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Conflicts of interest

Background. The choice of anaesthetic technique for patients undergoing joint arthroplasty is debatable. The hypothesis of this study was that general anaesthesia would generate a more favourable recovery profile than spinal anaesthesia.

Methods. We randomly allocated 120 patients to either intrathecal bupivacaine or general anaesthesia with target-controlled infusion

RCT OF THA PROTOCOL: TIVA VS SAB

- Similar RCT comparing GA (target-controlled infusion of propofol plus remifentanyl) vs SA (intrathecal bupivacaine) for THA in a fast-track setting in Sweden.
- Nearly identical protocol as TKA (but no LIA)
- Results:
 - LOS: GA 26h vs SA 30h
 - No difference in actual day of discharge
 - Lower initial pain scores in SA group, but after 6h higher pain scores were seen vs GA group
 - GA group had less dizziness & nausea, better ability to walk at 6h, & shorter PACU LOS
 - No difference was seen in blood loss, morphine consumption, need for bladder catheterization

SYSTEMATIC REVIEW: COGNITIVE DYSFUNCTION

SYMPOSIUM: PERIOPERATIVE PAIN MANAGEMENT IN ORTHOPAEDIC SURGERY

The Influence of Anesthesia and Pain Management on Cognitive Dysfunction After Joint Arthroplasty

A Systematic Review

Michael G. Zywił MD, Atul Prabhu MD,
Anthony V. Perruccio PhD, Rajiv Gandhi MSc, MD

Published online: 2 November 2013
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Abstract
Background Despite the overall success of total joint arthroplasty, patients undergoing this procedure remain susceptible to cognitive decline and/or delirium, collec-
Questions/purposes We systematically reviewed the English-language literature to assess the influence of the following anesthetic and/or pain management strategies on the risk for postoperative cognitive dysfunction in patients

SYSTEMATIC REVIEW: COGNITIVE DYSFUNCTION

- Systematic review looking postoperative cognitive dysfunction in elective joint replacement
 - RA showed benefit for first 7 days postoperatively
 - Optimize depth of anesthesia with GA – mixed evidence
- Other techniques that may improve PCD:
 - Non-opioid pain management techniques
 - Oral opioid preparations only
 - Avoid all morphine

SUMMARY: CHOICE OF ANESTHESIA

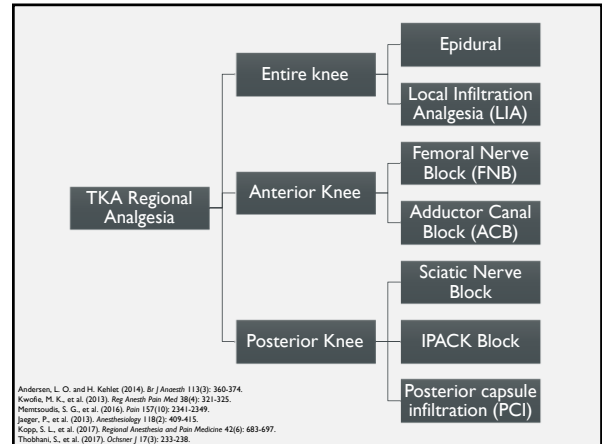
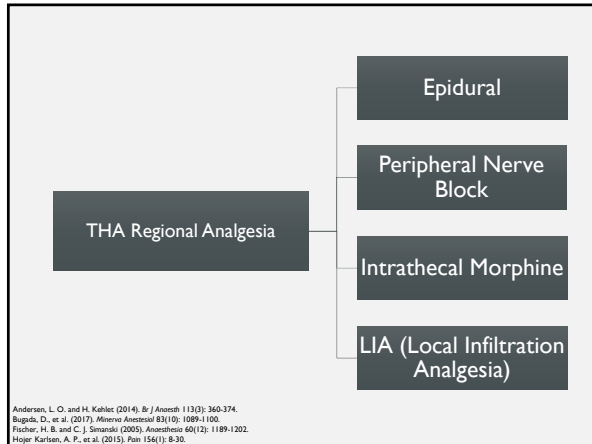
- Overall complication rates are low
- Neuraxial anesthesia probably underutilized
 - Patients with multiple comorbidities had significantly less complications
- Good outcomes with general anesthesia at some centers
- Specialized fast-track or enhanced recovery after surgery (ERAS) protocols may play a large role in outcomes differences

CHOICE OF ANALGESIA

Multimodal analgesia

- NSAIDs
- APAP
- Ketamine
- Gabapentinoids
- Local anesthetics
- Opioids

Colladay, G. J., et al. (2017). J Arthroplasty 32(9): 549-573.
 Buvanendran, A., et al. (2010). Anesth Analg 110(1): 199-207.
 Ramarand, P., et al. (2009). Anesth Analg 109(6): 1963-1971.
 Memonjee, S. C., et al. (2013). Reg Anesth Pain Med 38(6): 274-281.



LOCAL INFILTRATION ANALGESIA (LIA)

- Sample recipe (aseptic preparation):
 - 200mg ropivacaine
 - 30mg ketorolac
 - 0.5mg epinephrine
 - Dilute with isotonic saline to 100-150mL
- Adjuncts
- Liposomal bupivacaine
- Catheter in-situ
- THA infiltration sites
 - Acetabular capsule, adductor mm, gluteus medius m
 - External rotators
- TKA infiltration sites
 - Posterior capsule structures
 - Periprosthetic structures
 - Fascia and subcutaneous tissues

https://www.eyegors.com/intra-articular-and-peritarsular-infiltration-of-local-anesthetics

UCH PROTOCOLS: THA

| 2010 | 2015 | 2018 |
|----------------------------|----------------------------|-------------------------------|
| <u>Preop</u> | <u>Preop</u> | <u>Preop</u> |
| Oxycotin 10mg PO | - | - |
| APAP 1000mg PO | APAP 1000mg PO | APAP 1000mg PO |
| Celebrex 200mg PO | Mobic 7.5-15mg PO | Mobic 7.5-15mg PO |
| Pregabalin 75-150mg PO | Pregabalin 75-150mg PO | Pregabalin 75-150mg PO |
| <u>Regional</u> | <u>Regional</u> | <u>Regional</u> |
| Lumbar plexus block | - | - |
| GA vs Spinal | Spinal encouraged | Spinal unless contraindicated |
| ITM 250mcg | ITM 100mcg | - |
| <u>Postop</u> | <u>Postop</u> | <u>Postop</u> |
| Oxycotin 10mg BID PO | - | - |
| IV PCA x 24hrs, then | IV PCA for >50 MED | IV PCA for >50 MED |
| Oxycodone 5-10mg q6h PO | Oxycodone 5-10mg q6h PO | Oxycodone 5-10mg q6h PO |
| APAP 1000mg PO QID | APAP 1000mg PO QID | APAP 1000mg PO QID |
| Celebrex 200mg PO BID | Mobic 7.5-15mg QD PO | Mobic 7.5-15mg QD PO |
| Pregabalin 75-150mg PO BID | Pregabalin 75-150mg PO BID | - |

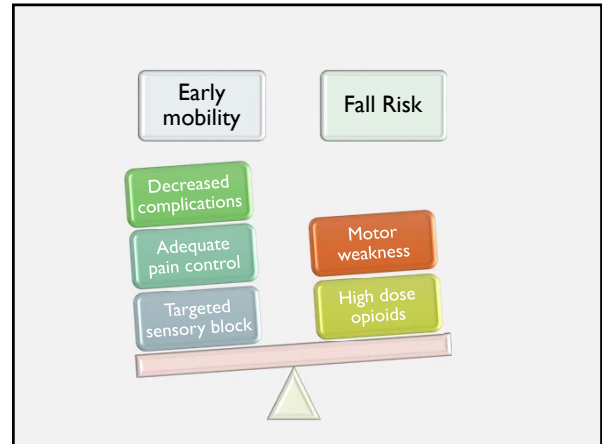
UCH PROTOCOLS: TKA

| 2010 | 2013 | 2015 | 2018 |
|----------------------------|----------------------------|----------------------------|-------------------------------|
| <u>Preop</u> | <u>Preop</u> | <u>Preop</u> | <u>Preop</u> |
| Oxycotin 10mg PO | Oxycotin 10mg PO | - | - |
| APAP 1000mg PO | APAP 1000mg PO | APAP 1000mg PO | APAP 1000mg PO |
| Celebrex 200mg PO | Celebrex 200mg PO | Mobic 7.5-15mg PO | Mobic 7.5-15mg PO |
| Pregabalin 75-150mg PO | Pregabalin 75-150mg PO | Pregabalin 75-150mg PO | Pregabalin 75-150mg PO |
| <u>Regional</u> | <u>Regional</u> | <u>Regional</u> | <u>Regional</u> |
| Femoral NB catheter | Femoral NB catheter | Adductor canal single shot | Adductor canal single shot |
| Sciatic single shot | - | - | - |
| GA vs Spinal | GA vs Spinal | Spinal encouraged | Spinal unless contraindicated |
| ITM 250mcg | ITM 250mcg | ITM 100mcg | - |
| <u>Postop</u> | <u>Postop</u> | <u>Postop</u> | <u>Postop</u> |
| Oxycotin 10mg BID PO | Oxycotin 10mg BID PO | - | - |
| IV PCA x 24hrs, then | IV PCA x 24hrs, then | IV PCA for >50 MED | IV PCA for >50 MED |
| Oxycodone 5-10mg q6h PO | Oxycodone 5-10mg q6h PO | Oxycodone 5-10mg q6h PO | Oxycodone 5-10mg q6h PO |
| APAP 1000mg PO QID | APAP 1000mg PO QID | APAP 1000mg PO QID | APAP 1000mg PO QID |
| Celebrex 200mg PO BID | Celebrex 200mg PO BID | Mobic 7.5-15mg QD PO | Mobic 7.5-15mg QD PO |
| Pregabalin 75-150mg PO BID | Pregabalin 75-150mg PO BID | Pregabalin 75-150mg PO BID | - |

CHRONIC PAIN PATIENTS

- Titrate down opioids preoperatively if able
- Consider more aggressive modalities when indicated
 - ITM added to spinal
 - Preincisional ketamine (0.3-0.5mg/kg IV)
 - Consider infusion postoperatively in severe cases
 - IV PCA for 24-48 hours postop
 - Catheter techniques when available

ENHANCED RECOVERY PATHWAYS FOR TOTAL JOINT SURGERY



- ### CHANGES IN PRACTICE
- Shorter stays – “Fast Track”
 - More aggressive rehabilitation programs
 - Emphasis on function over “no pain”
 - Decreased use of opioids
 - Partnerships between Acute Pain Medicine specialists and Orthopedic surgeons
- L.E. Wendling

- ### INTERDISCIPLINARY TEAM
- Orthopedic surgeon
 - Outpatient PT
 - Clinic & hospital coordinators
 - Respiratory therapy
 - Nursing
 - Dietary
 - Inpatient PT/OT
 - Pastoral care
 - Anesthesia ←
 - Organizational quality
 - Pharmacy
 - Hospitalist
 - Case Manager/Social Worker

JOINT COMMISSION: THKR CERTIFICATION

https://www.jointcommission.org/assets/1/6/THKRIP_Manual2018January_New.pdf

| Set Measure ID | Measure Short Name |
|----------------|--|
| THKR-IP-1 | Regional Anesthesia |
| THKR-IP-2 | Postoperative Ambulation on Day of Surgery |
| THKR-IP-3 | Discharged to Home |
| THKR-IP-4 | Preoperative Functional/Health Status Assessment |

- ### AMERICAN ACADEMY OF ORTHOPAEDIC SURGEONS
- Guidelines to assist with the following:
- Antimicrobial prophylaxis in surgery
 - Surgical site infection: Prevention and treatment of surgical site infection
 - VTE prophylaxis

OTHER ELEMENTS OF ERAS

- Decrease number of drains
- Temperature management
 - Active warming
- Glucose control
- PONV prophylaxis
- Urinary tract infections
 - Decrease bladder catheterizations
 - Urinary retention protocols
- Blood transfusions
 - TXA administration

Galbraith, A. S., et al. (2018). *Br J Med Sci* 187(1): 97-109

BLADDER SCAN PROTOCOL

- (1) Bladder volume, <300ml, repeat bladder scan within 3h
- (2) 300–399 ml, repeat bladder scan within 2 h
- (3) 400 – 499 ml, repeat bladder scan within 1 h
- (4) ≥500 ml, do intermittent catheterization
 - This can be repeated twice after which an indwelling urinary bladder catheter is used.

SUMMARY

- Changes in practice toward early recovery programs has shifted priorities in care
 - Improved function over "zero pain"
 - Decreased reliance on opioids
- Evidence-based choices for anesthesia, especially in high risk populations
 - Neuraxial anesthesia
 - Multimodal analgesics
 - Regional anesthesia for pain control that works for your institution & practice model