Implementation of a Total Joint Replacement-Focused Perioperative Surgical Home: A Management Case Report

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BACKGROUND: The perioperative setting in the United States is noted for variable and fragmented care that increases the chance for errors and adverse outcomes as well as the overall cost of perioperative care. Recently, the American Society of Anesthesiologists put forward the Perioperative Surgical Home (PSH) concept as a potential solution to this problem. Although the PSH concept has been described previously, "real-life" implementation of this new model has not been reported.

METHODS: Members of the Departments of Anesthesiology and Perioperative Care and Orthopedic Surgery, in addition to perioperative hospital services, developed and implemented a series of clinical care pathways defining and standardizing preoperative, intraoperative, postoperative, and postdischarge management for patients undergoing elective primary hip (n = 51) and knee (n = 95) arthroplasty. We report on the impact of the Total Joint Replacement PSH on length of hospital stay (LOS), incidence of perioperative blood transfusions, postoperative complications, 30-day readmission rates, emergency department visits, mortality, and patient satisfaction.

RESULTS: The incidence of major complication was 0.0 (0.0–7.0)% and of perioperative blood transfusion was 6.2 (2.9–11.4)%. In-hospital mortality was 0.0 (0.0–7.0)% and 30-day readmission was 0.7 (0.0–3.8)%. All Surgical Care Improvements Project measures were at 100.0 (93.0–100.0)%. The median LOS for total knee arthroplasty and total hip arthroplasty, respectively, was (median (95% confidence interval [interquartile range]) 3 (2–3) [2–3] and 3 (2–3) [2–3] days. Approximately half of the patients were discharged to a location other than their customary residence (70 to skilled nursing facility, 1 to rehabilitation, 39 to home with organization health services, and 36 to home).

CONCLUSIONS: We believe that our experience with the Total Joint Replacement PSH program provides solid evidence of the feasibility of this practice model to improve patient outcomes and achieve high patient satisfaction. In the future, the impact of LOS on cost will have to be better quantified. Specifically, future studies comparing PSH to traditional care will have to include consideration of postdischarge care, which are drivers of the perioperative costs. (Anesth Analg 2014;118:1081–9)

Health care delivery in the United States is currently plagued by variability in care, excessive cost, and poor outcomes.[1,2] In the perioperative setting, widely variable and fragmented perioperative care exposes surgical patients to lapses in expected standards of care, increases potential for mistakes and accidents in the operating room, results in unnecessary and potentially detrimental tests, needlessly drives up costs, and adversely affects the patient health care experience.[3–7] Even for higher volume and thus relatively routine surgical procedures, such as total knee arthroplasty (TKA), there are substantial variations in surgery times, hospital length of stay (LOS), discharge dispositions, and in-hospital complication rates across institutions.[8]

Recently, the American Society of Anesthesiologists indicated that a paradigm of standardized patient preoperative evaluation and preparation, along with meticulous team-based and evidence-driven care during and after surgery, has the potential to accomplish Berwick's Triple Aim of improving the individual experience of care; improving the health of populations; and reducing per capita costs of care.[a] To achieve this goal, the American Society of Anesthesiologists has developed the concept of the Perioperative Surgical Home (PSH) and has characterized it as "a patient-centered and physician-led

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[a] ASA Committee on Future Models of Anesthesia Practice Annual Report to the house of delegates. Accessed August 18, 2013.

[b] American Society of Anesthesiologists: The perioperative or surgical home. Washington, DC: American Society of Anesthesiologists; 2011(https://www.asahq.org/~/media/For%20Members/Advocacy/Legislative%20Conference/2011%20-%20One-pager%20Perioperative%20Surgical%20Home%20Pilot%20Project.pdf).

multidisciplinary and team-based system of coordinated care that guides the patient throughout the entire surgical experience."[b] The central tenet of the PSH is to treat the entire perioperative episode as 1 continuum of care rather than discrete preoperative, intraoperative, and postoperative episodes. This single perioperative experience lasts from the moment the decision is made for the patient to have surgery until 30 days after discharge from the hospital. Indeed, in parallel to the Triple Aim promoted by Berwick, to improve the individual experience of care, to improve the health of the population, and to reduce per capita costs of care for surgical patients, the aim of the PSH is to provide better quality and better service within the context of lower costs for our surgical patients.[9,10] Although the PSH concept has recently been described and discussed by several authors,[11–13] the actual implementation of this new model of care and its "real-life" evaluation have not been reported.

In April 2012, our group at University of California (UC) Irvine Health initiated the process of building a PSH aimed at providing services to patients undergoing primary total hip arthroplasty (THA) or TKA. Under the Total Joint Replacement Perioperative Surgical Home (Total Joint-PSH), initiative members of the Departments of Anesthesiology and Perioperative Care and Orthopedic Surgery, along with colleagues from all perioperative hospital services, developed and implemented a series of clinical care pathways defining and standardizing preoperative, intraoperative, postoperative, and postdischarge management for this patient group.

The goals of this article are to describe the development and implementation of the Total Joint-PSH at our institution and to report our initial 12-month experience with this program. We hypothesized that the implementation of the Total Joint-PSH is feasible and has the potential to result in significant improvement in a series of conventional perioperative outcome variables.

METHODS

The Total Joint-PSH initiative described in this article includes all consecutive patients who underwent elective primary TKA and THA at our institution between October 1, 2012, and September 30, 2013. IRB approval was obtained with the purpose of analyzing and reporting our results, and patient consent was waived (IRB HS#2012–9273). The STROBE (Strengthening the Reporting of Observational studies in Epidemiology) statement/checklist[14] was followed for reporting of the results of this cohort study.

Setting

To understand the implementation process of the Total Joint-PSH at UC Irvine Health, consideration of the overall background is important as described in the *The Open Mind* article by Kain et al.[9] Briefly, in April 2012, UC Irvine Health decided to reestablish a joint replacement center after the previous center closed in 2007. Between 2007 and 2012, only 81 elective TKA and THA surgeries were performed at our institution by volunteer faculty. The opening of the new total joint replacement center created ideal conditions for the establishment of the Total Joint-PSH. Concurrently, UC Irvine Health engaged the entire organization in a Lean Six Sigma (LSS) initiative[15] that was led by the Chief Operating Officer and the Chair of the Department of Anesthesiology and Perioperative Care. As a result of this new initiative, most of the faculty in the Department of Anesthesiology and Perioperative Care were trained in LSS, along with all anesthesia CA-1 residents and many members of the perioperative staff, which included nurses, operating room technicians, and operating room administrators.

Planning the Total Joint-PSH Initiative

Our goal was to integrate 4 distinct perioperative components: preoperative, intraoperative, postoperative, and postdischarge components, as well as metrics and quality assurance and research components.

Creating the Total Joint-PSH Team

In April 2012, a Total Joint-PSH steering committee was created. This steering committee was composed of 8 anesthesiologists, 2 surgeons, 3 nurses, 2 pharmacists, 1 physical therapist, 1 case manager, 1 social worker, and 2 information technology experts. The steering committee met weekly during the implementation phase (from April 1, 2012, to October 1, 2012) and quarterly once the Total Joint-PSH became operational (from October 1, 2012, to present). All team members underwent training in LSS and value stream mapping (a lean tool that uses a flow diagram documenting in high detail every step of a process) for all the perioperative processes that were developed. In May 2012, a daylong retreat was held for the steering committee and the process champions, who were the chairs of the Departments of Anesthesiology and Orthopedic Surgery along with the Chief Operating Officer of the hospital. During this retreat, decisions were made regarding who would serve as the various team leaders as well as membership for each of the working groups that reported to the steering committee. A decision was made to use the conceptual framework of LSS and adhere to standardization and reduced variability as much as possible. To achieve this aim, a clinical care pathway was developed and is briefly described below and in Figure 1.

Development of Clinical Care Pathways and Outcomes

Evidence-based practice was implemented within the clinical care pathways after consensus agreement among the specific team members. After review of the current literature, level 1 recommendations were adopted. Where level 1 evidence was lacking, team consensus was required to adopt a practice guideline with a lower level of evidence. For example, thromboembolic events prevention protocols were established using level 1A (consistent evidence from randomized controlled trials without important limitations or exceptionally strong evidence from observational studies) and 1B (evidence from randomized controlled trials with important limitations) data from the

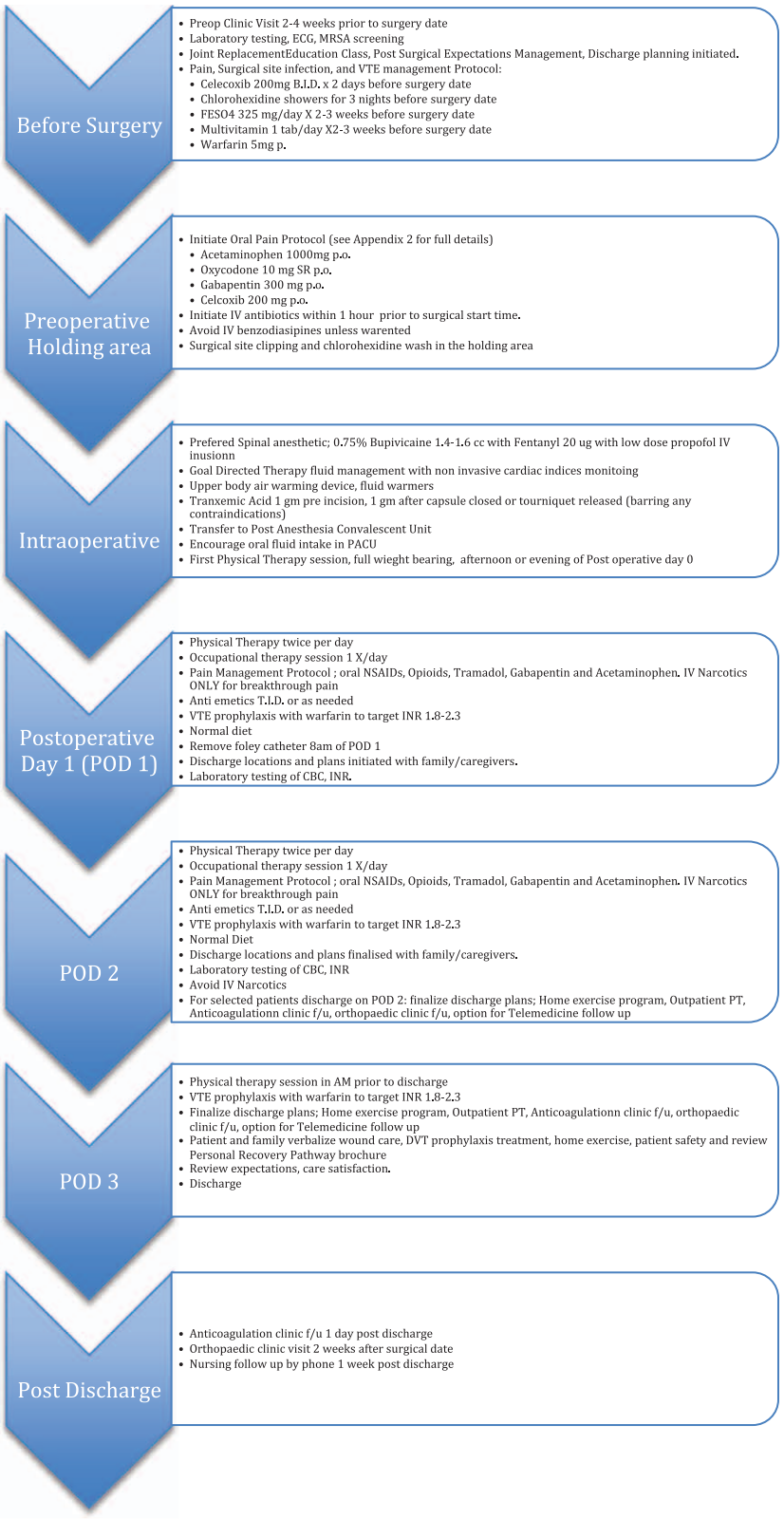

Figure 1. Flowchart of clinical care pathway for the Joint-Perioperative Surgical Home. MRSA = methicillin-resistant *Staphylococcus aureus*; VTE = venous thromboembolism; $FeSO_4$ = iron sulfate; PACU = postanesthesia care unit; NSAID = nonsteroidal anti-inflammatory drug; PT = physical therapy; ECG = electrocardiogram; INR = international normalized ratio; CBC = complete blood count.

latest American Academy of Orthopaedic Surgeons and the American College of Chest Physician guidelines.[16,17] Infectious prevention protocols were adapted from the latest guidelines provided by the Musculoskeletal Infection Society and the International Consensus Meeting on Periprosthetic Joint Infections.[18–20] Figure 2 shows the main items of the clinical care pathway as they were implemented for the Total Joint-PSH and as they compare with the usual care that was provided before we initiated this program.

Phase	Element of Care	Perioperative Surgical Home	Standard Care
Preoperative	Patient education	Mandatory Joint Replacement education classes, Written education material, Mind Body classes for optimal perioperative healing	Written education material and Joint Replacement education classes optional
	Preoperative testing	Preoperative clinic visit with protocolized laboratory and ECG testing, MRSA swab, anemia management protocols	Lack of protocolized preoperative testing
	NPO guidelines	NPO to solids after midnight and clear liquids up to 2 hour before arrival to hospital	NPO to solids and liquids after midnight
	Standardized preoperative order sets	Standardized electronic order sets for VTE prophylaxis and initiation of multimodal pain regimen preoperatively	Generic order forms with lack of preop order sets
	Discharge Planning	DME purchase and patient education, identification of post op care taker, engagement of home health agencies	Delayed discharge planning after patient admitted to the hospital
Intraoperative	Anesthesia care	Standardized anesthesia protocols with spinal as preferred anesthetic	Anesthetic choice and fluid management at the discretion of the anesthesia provider
	Equipment/implants and prosthesis	Goal Directed therapy as standard for fluid management Standardized equipment per procedure cards, single vendor for most implants and prosthesis	Equipment per individual surgeon preference cards, multiple vendors for I implants and prosthesis
	Pain regimen	Multimodal with intra articular analgesia	Intrathecal opioids, epidural analgesia
Post operative	Pain management	Standard postoperative multimodal pain management protocol, with emphasis on oral medication and avoidance of opiates by protocol	Use of opioids and PCA
	Physical Therapy	Early mobilization with full weight bearing on POD 0	Usually mobilization on POD 1
	Nutrition	Advance to normal diet on POD 0	Not standardized
	Protocols for escalation of care	Decision tree for rapid escalation of care in case of medical deterioration	Same as other areas of the hospital
Post Discharge	Recovery Plan	Standardized personal recovery plan, including physical therapy, ambulation, anticoagulation management and wound care	Variable plan dependent on home health agency
	Patient follow up protocols	Follow up includes telemedicine by surgeon, Nurse Navigator phone call and Orthopedic clinic visit	Follow up by Orthopedic clinic days to weeks postoperatively
Monitoring	Audit plan	Aggressive audit schedule for quality measures and adherence to care path	Lack of regular audits

Figure 2. Main items of the clinical care pathway for the Joint-Perioperative Surgical Home compared with usual perioperative care. MRSA = methicillin-resistant *Staphylococcus aureus*; VTE = venous thromboembolism; POD = postoperative day; ECG = electrocardiogram; NPO = Nothing Per Os; DME = durable medical equipment; PCA = patient controlled analgesia.

Preoperative Components (Fig. 1)

After receiving a short introduction to the PSH process by the orthopedic nurse practitioner in clinic, patients were scheduled to participate in the preoperative joint replacement education class and a Mind-Body Surgical Preparation class. In addition, all patients were seen in a preoperative anesthesia center by a nurse practitioner supervised by an anesthesiologist 2 to 4 weeks before the surgical date and preoperative risk stratification and optimization processes were followed. Standardized testing and management protocols, including nasal *Staphylococcus aureus* screening and nosocomial infection prevention protocol, thromboembolic risk and prevention protocol, blood conservation strategies, and urinalysis protocol were instituted (Figs. 1 and 2).

Intraoperative Component

All patients received protocol-driven, standardized pain management based on a preoperative multimodal oral pain medication regimen starting the morning of the surgery (Fig. 1). Fluid management was standardized and was based on goal-directed therapy protocol (Nexfin CC, Edwards Lifesciences, Irvine, CA).[21–23] Nursing, surgical equipment, and procedures were all standardized with the use of LSS techniques. Consistency was achieved by creating an anesthesia Total Joint-PSH intraoperative team, and only those faculty (n = 5) were assigned to these cases. Details can be obtained by personally contacting the authors of this article.

Postoperative Component (Figs. 1 and 2)

Protocols developed for the acute postoperative care team included multimodal pain regiment protocols (Table 1), pharmacy-led anticoagulation and thromboembolic event prevention protocols, and intensive physical therapy (PT) protocols starting on the day of surgery with 2 sessions daily (Fig. 1). The coordination of care, as well as the management of any postoperative medical issues, was handled by a dedicated anesthesiology-based 24/7 PSH Team. This PSH Team consisted of a senior (CA-3) anesthesia resident and a dedicated PSH anesthesia faculty available 24/7 through a dedicated pager. Decisions about blood transfusion were made jointly by the surgeon and anesthesiologists based on hemoglobin levels, symptoms, and patient medical history. As a general guideline, the hemoglobin transfusion trigger was 10 mg/dL in patients with known coronary artery disease and 7 mg/dL for the other patients. Before discharge, the nursing staff, the orthopedic surgical team, and the anesthesiology-based PSH team explained all postoperative discharge instructions.

Table 1. UCI Medical Center Joint Surgical Home Pain Management Protocol

Preoperative holding area
- Acetaminophen 1000 mg orally, per os NOW
- Oxycodone sustained released 10 or 20 mg orally, per os NOW
- Gabapentin 300 or 600 mg orally, per os NOW
- Celecoxib 200 or 400 mg orally, per os NOW (If history of serious allergy or intolerance to "sulfa drug," use etodolac 500 mg orally, per os NOW instead of celecoxib 200 or 400 mg)

Intraoperative
- Anesthesia
  - Bair hugger
  - Blood warmer
  - Antibiotics
- Spinal kit + meds
  - 1.4–1.6 mg 0.75% bupivacaine + 20 μg fentanyl
- Intraoperative periarticular mixture total 100 mL volume ONCE in divided doses
  - Epinephrine 1 mg/mL; 0.5 mL
  - Ketorolac 30 mg/mL; 1 mL
  - Clonidine 100 μg/mL; 0.8 mL
  - Ropivacaine 5 mg/mL; 49.25 mL
  - Sodium chloride 0.09%: 48.45 mL

PACU
- Acetaminophen 1000 mg + oxycodone 10 mg orally, per os in PACU
- PRN VAS pain score = 4
- Opiates prn; dilaudid in divided doses

Patient care unit
- Acetaminophen 1000 mg orally, per os every 8 h. Around the clock. Start 8 h from NOW dose. Not to exceed 4 g per 24 h
- Oxycodone sustained released 10 or 20 mg orally, per os every 12 h. Start 12 h from NOW dose
- Gabapentin 300 mg orally, per os every night at bedtime. Adjust for renal impairment
- Tramadol 50 mg orally, per os every 6 h PRN—mild pain. Use with caution in patient with seizure history
- Oxycodone immediate release 10 mg orally, per os every 4 h PRN—moderate pain
- Oxycodone immediate release 10 mg orally, per os every 4 h PRN—severe pain
- Ketorolac 7.5 mg IV every 6 h ×2 doses. Start 6 h after surgery completed
- Hydromorphone 0.2–0.4 mg IV push every 2 h PRN breakthrough pain

PACU = postanesthesia care unit; VAS = Visual Analog Scale; PRN = Pro Re Nata.

Postdischarge Component (Fig. 3)

The goal was to avoid readmissions by developing and implementing guidelines for discharge orders, discharge instructions, medication prescriptions, wound care, and follow-up clinic visits. Before discharge, patients were scheduled to attend our coagulation clinic 2 to 3 days after discharge and for a follow-up visit with the orthopedic surgeon 2 weeks after the surgical date.

Outcome Data Collection

Prospectively collected data included patient demographics, hospital LOS (defined as postoperative number of nights in the hospital after surgery), 30-day readmission rate, first case start time in the morning, turnover time of the operating room, all University Health Consortium data as well as Surgical Care Improvement Project (SCIP) data, including antithrombotic treatment, proper timing, choice and discontinuation of prophylactic antibiotic treatment, early removal of Foley catheters, and proper hair removal from surgical site. Postoperative pain scores (Numerical Rating Scale between 0—"no pain" and 10—"worst possible pain") were measured every 6 hours and averaged over the first 48 hours. Data on the following perioperative complications were collected: periprosthetic joint infection, mechanical complications, wound healing complications, pulmonary embolism, death, acute myocardial infarction, pneumonia, sepsis, deep vein thrombosis, urinary tract infection, stroke, delirium, atrial fibrillation, acute kidney injury, and nausea and vomiting. These complications were defined and categorized as major complications based on the Yale New Haven Health Services Corporation/Center for Outcomes Research and Evaluation criteria used by the Centers for Medicare and Medicaid Services (CMS) for hospital-level performance measures for elective THA and TKA.[24] Periprosthetic joint infection, mechanical complications, wound healing complications, pulmonary embolism, death, acute myocardial infarction, pneumonia, and sepsis were classified as major complications.[24]

Minor complications (Table 3) were defined as any event noted in the discharge summary unique to routine postoperative hospital course. We also performed an analysis of our patient cohort data for postoperative allogeneic blood product transfusion rate. Integrity of all data points was confirmed using Decision Support (hospital based), electronic medical record (Quest, Allscripts, Chicago, IL), and anesthesia information management system (SIS, SISFirst, Apharetta, GA). External validity of our metrics was based on current peer-reviewed literature prepared for CMS, establishing national benchmarks.[24] We used CMS benchmarks since Medicare is the single largest payer for these procedures, covering approximately two-thirds of all THAs and TKAs performed in the United States.[25]

Data Analysis

Data are presented as median (95% confidence interval [CI] for median) [interquartile range] and mean ± SD. Incidence of outcome data is presented as percent (95% CI). Both 95% CI for median and incidence of outcome were calculated using the

	Essential Components
Day of Discharge	• **Postoperative discharge instructions for wound care, follow up orthopedic clinic visits, reviewed and explained by:** - **Nursing Staff** - **Orthopedic surgical team** • **Post-discharge Pain medications reviewed by:** - **Anesthesia led Surgical Home Team with input from Acute Pain Service** • **Verification that all equipment needs; walker, cane, commode, were ordered and delivered to patient either in hospital or to his/her home or discharge facility.** • **Anti-coagulation clinic visit scheduled for 2 days post discharge.**
Post Discharge through 30 days	• **Orthopedic clinic visit scheduled for 2 weeks and 3 months post-operatively, and optional supplemental telemedicine visits on weeks 1,3,4,6,9.** • **Follow up phone call by dedicated orthopedic nursing staff 1-week post discharge to assess patient satisfaction and compliance with post discharge instructions.**

Figure 3. Essential postoperative component of the Perioperative Surgical Home.

Table 2. Demographics

	THA *n* = 51	TKA *n* = 95
Age mean	64 ± 2.68	66 ± 10.08
BMI mean	27.4 ± 6.1	29.8 ± 6.11
Anesthesia type		
Spinal	75%	71%
General	25%	29%
Payor mix		
Medicare	50%	52%
Medi-Cal	24%	17%
Commercial	26%	31%
ASA physical status		
I	2.04%	0.00%
II	30.61%	19.10%
III	65.31%	75.28%
IV	2.04%	5.62%
OR duration (h)	2.0 ± 0.65	3.0 ± 0.67

Data are expressed as median ± SD.
THA = total hip arthroplasty; TKA = total knee arthroplasty; BMI = body mass index; OR = operating room.

Clopper-Pearson method.[26] Incidences of outcome (e.g., cancellation) were sufficiently rare that they could not cluster among days (i.e., there were many 4-week periods with 0 events).[27]

RESULTS

Demographics

There were 146 sequential total primary joint arthroplasty patients who followed the Total Joint-PSH protocol, with 51 THA and 95 TKA. Baseline demographics of all cases and duration of surgery included in our analysis are presented in Table 2.

Table 3. Minor Complications

Complication type	
Foot drop	2
Delirium	1
Acute kidney injury	1
Urinary retention	1
Nausea/vomiting	1
Anemia	6
Hypotension/anemia	2
Respiratory distress	1

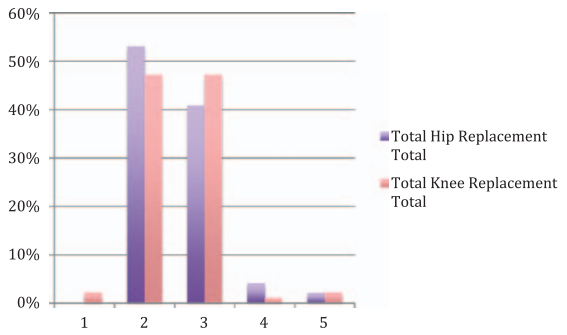

Figure 4. Length of stay in hospital of the patient population.

Outcomes

Operative Outcomes

The median LOS for patients undergoing THA was 3 (2–3) days, and the median LOS for patients undergoing TKA was 3 (2–3) days [2–3] (Fig. 4). Approximately half of the patients were discharged to a location other than their customary residence (70 to skilled nursing facility, 1 to rehabilitation, 39 to home with organization health services, and 36 to home).[28] Emergency department visit rates within 30 days of discharge were 3.9 (0.5–13.5)% for THA and 4.2 (1.2–10.4)% for TKA, and the 30-day hospital readmission rate was 0.0 (0.0–7.0)% for THA and 1.1 (0.0–5.7)% for TKA. Overall, 92% of all cases started at 07:15 AM, which is our institution's first case start time, and the turnover time in the operating room was 28 ± 4.9 minutes. Only 1 case was canceled on the day of surgery (0.7 [0.0–3.8]%) because of new onset of skin infection in proximity to the surgical site.

Safety Outcomes

Overall 30-day mortality was 0.0 (0.0–2.5)%, and during the study period, there were no incidences of any national benchmark major complications, as outlined by Grosso et al.[24] Our overall minor complication rate was 10.5 (3.3–12.2)% (Table 3). No patient received an intraoperative blood transfusion. Our autologous blood transfusion rate for THA in the postoperative period was 9.8 (3.3–21.4)% and for TKA in the postoperative period was 4.2 (1.2–10.4)%. All SCIP indicators were at 100.0 (93.0–100.0)% performance for all 146 cases.

Patient-Centered Outcomes

The median Numerical Rating Scale (0–10) in the postoperative period were 3.3 postoperative day (POD) 0 (1.6–3.3), 3.0 (3–5.5) POD 1, 3.2 (2.3–5.1) POD 2, and 2.7 (1.8–5) POD 3. All patients (100%) received 2 sessions of PT in the first 24 hours after surgery, and all patients who arrived

to the inpatient floor before 4:00 PM received PT on POD 0. The orthopedic nursing staff mobilized patients arriving after 4:00 PM to the inpatient floor. Ninety-seven percent of patients reported no nausea or vomiting throughout their hospital stay, and there was only 1 case of severe nausea and vomiting after surgery. Patient satisfaction scores were in the 98th percentile by Press Ganey satisfaction scores.

DISCUSSION

Postoperative LOS is a significant contributor to overall cost of total joint arthroplasty,[29,30] and preoperative, intraoperative, and postoperative variables all contribute to the LOS.[31] Future studies, based on the model we describe in this management case report, will have to test this hypothesis using appropriate research strategies. In addition, since the goal is to improve the health care system and not only the institution, in the future, the impact of LOS on cost will have to be better quantified. Specifically, future studies comparing PSH to traditional care will have to include consideration of postdischarge care, which are drivers of the perioperative costs.[c] As a matter of fact, Kirksey et al.[28] have shown that in the setting of joint surgery, a significant number of events occur after discharge.

Vorhies et al.[32,33] examined the Medicare Patient Safety Monitoring System and reported that during 2002 to 2007 LOS after primary THA was 4.2 ± 2.2 and 3.9 ± 1.9 days for TKA. Another study, with 3432 patients undergoing THA and 5718 undergoing a TKA from Southern California Kaiser Permanente, reported a LOS of 3.6 days.[34] In our institution, after implementation of the Total Joint-PSH, our patients had a comparable or perhaps lower mean LOS, 2.7 ± 0.64 days for TKA and 2.6 ± 0.67 days for THA. This will need to be formally tested while stratifying by postdischarge care in future studies as Kirksey et al.[28] reported that nationally more than half of patients are discharged to a location other than their customary residence.

In our cohort, there were no major complications and the Total Joint-PSH anesthesia team promptly handled all minor complications. Our readmission rates (0.0 [0.0–7.0]% for THA and 1.1 [0.0–5.7]% for TKA) are comparable or low. Zmistowski et al.[35] in a single-center study of 10,633 primary THA patients found a 3.1% 30-day unplanned readmission rate. Pugely et al.[36] evaluated the 2011 American College of Surgeons National Surgical Quality Improvement Program database to identify 11,814 and 8105 patients undergoing primary elective TKA and THA, respectively. They found a 30-day readmission rate of 4.6% and 4.2% for THA and TKA, respectively.

We may have had a lower incidence of perioperative transfusions (9.8 [3.3–21.4]% for THA and 4.2 [1.2–10.4]% for TKA) in comparison to a study looking at the U.S. Nationwide Inpatient Sample database that found transfusion rates after THA increased from 18.12% in 2005 to 21.21% in 2008.[37] After a 1-year evaluation of our protocols, we have revised our anemia management protocols to include a full anemia workup by a hematology consult for patients with hemoglobin of <10 g, and for patients with hemoglobin of 10 to 12 g, we initiate treatment with erythropoietin with supplemental iron. From our feasibility study and given our sample size, we suggest that transfusion is a viable end point, even though it will remain a surrogate end point.

With our program, our patients entered the postoperative and postdischarge periods optimized for recovery. For example, pain management focused on oral medication and avoidance of opioids to reduce LOS while at the same time controlling patient pain throughout the perioperative period, as evidenced by our patient's low pain visual analog scale scores. Other factors that optimized recovery included prompt removal of urinary catheters, when present, and early mobilization. Within 24 hours, 100 (93–100)% of patients received 2 sessions of PT and all were full weight bearing on POD 0. All patients who arrived to the inpatient floor by 4:00 PM received a PT session on POD 0. The orthopedic nursing staff mobilized all other patients arriving after 4:00 PM to the inpatient floor. This is comparable to the 36% mobilization on the day of surgery recently reported from Enhanced Recovery After Surgery programs.[38]

To achieve the results reported here, we suggest that the entire bundle of the PSH is needed, with protocolization of preoperative, intraoperative, postoperative, and postdischarge care. Moreover, the use of LSS to reduce variability and increase standardization was a very important component in our program. Adherence to our clinical care pathway was strictly monitored and any deviation was managed by our Surgical Home Team.

While we encountered some challenges at the onset of Total Joint-PSH, particularly with adherence to the protocols, the teamwork and coordination of postoperative care by the PSH anesthesia and orthopedic teams allowed the program to stay on track. A major challenge facing our institution as we scale up the PSH to all perioperative services is postoperative patient care coordination and management by the Department of Anesthesiology and Perioperative Care. With the Total Joint-PSH, the anesthesia regional/acute pain team handled postoperative PSH patient care management. This model, however, is not viable when considering the entire spectrum of perioperative services. Other institutions, such as University of Alabama, address this issue by using critical care medicine services. This is certainly a viable option; however, we are seriously exploring the concept of designated anesthesiologists to supervise dedicated PSH nurse practitioners.

Enhanced patient-centered care was exemplified by shared decision making at every phase and by the Joint Education and Mind-Body Surgical Preparation classes offered preoperatively to all joint surgical patients. The patient is an integral part of the entire care plan. From the decision to undergo the procedure, through discharge and follow-up care, the patient is involved in all aspects of their care. Stewart et al.[39] examined how patient-centered practice could impact medical care utilization and found that patient-centered communication was correlated with patient perceptions of common ground with physicians. In addition, patient perception of patient-centeredness was associated with positive health outcomes and lower levels of postencounter discomfort (Oates 2000). Patient engagement and active participation in the care process are an integral part of our PSH program.[39]

In this management case report, we describe the development and implementation of a Total Joint-PSH. We observed a

[c]Urbel P. Variation In Medicare Costs Is Mainly Due To Post-Acute Care. Forbes. May 30, 2013. Last accessed January 18, 2014. http://www.forbes.com/sites/peterubel/2013/05/30/variation-in-medicare-costs-is-mainly-due-to-post-acute-care/

cancellation rate of 0.7 (0.0–3.8)% and 100 (93–100)% adherence to all SCIP measures. Particularly noteworthy are the LOS, complication rate, rates of visits to the emergency department post-discharge, and readmission. *The Open Mind* articles,[9,10] as well as the editorial, in this issue of *Anesthesia & Analgesia* present a conceptual discussion of the topic of the PSH. As such, we will limit the comments in this article to the findings of this case study.

Research in the area of the PSH is complicated and ideally should be based on the principles outlined by Vetter et al.[12] Unfortunately, because our Total Joint-PSH program was tested in the setting of a newly established clinical service, we could not compare our results with previous outcomes in our institution. However, we believe that our experience with the Total Joint-PSH program provides solid evidence of the feasibility of this practice model to improve patient outcomes and achieve high patient satisfaction.

A limitation of this report is that as an observational study we have no control group for comparison. Furthermore, while Press Ganey[d] satisfaction scores were vastly above average (98th percentile in comparison with other hospitals participating in Press Ganey), the survey used was not validated to this particular patient population. Future studies using comparative effectiveness research methodologies should be conducted to quantify the impact of the PSH. As a case management report with comparison to national benchmarks, we describe the feasibility of the PSH and methodologies to facilitate its implementation. We believe that our approach is repeatable and can be used by other institutions to implement this new model of care. We do want to indicate, however, that the UC Irvine Total Joint Replacement Program is simply 1 example of applying the principles of the PSH, and many other examples will be brought forth as the PSH model will become more popular.

As a field, anesthesiology has an opportunity to dramatically change the culture of care in the United States through establishing the PSH model in our respective institutions. We realize and fully agree that significant additional research and analysis are needed. Most indicators suggest that the practice of anesthesia is changing. The PSH model offers anesthesiologists a concrete way to demonstrate their continued value to their patients and to their hospitals by influencing better outcomes and decreasing cost. ■

RECUSE NOTE

Dr. Maxime Cannesson is the Section Editor for Technology, Computing, and Simulation for the Journal. This manuscript was handled by Dr. Steven L. Shafer, Editor-in-Chief, and Dr. Cannesson was not involved in any way with the editorial process or decision.

DISCLOSURES

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Contribution: This author helped design and conduct the study, analyze the data, and write the manuscript.
Attestation: Leslie Garson has seen the original study data, reviewed the analysis of the data, approved the final manuscript, and is the author responsible for archiving the study files.
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[d]http://www.pressganey.com.

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