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Outpatient (Same-Day) Total Hip Replacement

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Summary

- Total hip replacement, or total hip arthroplasty (THA), is a widely used procedure that can alleviate pain and disability in people with hip disorders such as osteoarthritis.
- Hospital length of stay for hip replacement has been decreasing, leading to gains in efficiency. Medical practitioners continue to seek ways to further reduce length of stay without increasing adverse effects.
- Same-day discharge involves a multidisciplinary approach using careful patient selection, patient education, improved anesthesia and analgesia, advanced surgical techniques with minimal muscle damage and blood loss, early mobilization and intensive physical therapy, and the active involvement of caregivers at home.
- A systematic review and seven subsequent studies support the efficacy and safety of same-day THA. They indicate that this approach results in high levels of patient function and satisfaction, as well as decreased health care system costs.
- Studies to date have generally included patients who are younger, thinner, and healthier than the average patient receiving a THA. Evidence in a more representative group of patients would be useful, and at least one such study is now underway.
- Same-day discharge surgery is also being investigated for total knee replacement.

Background

Osteoarthritis is a leading cause of pain, disability, and health care use among adults in Canada, with the hip being the second most common large joint affected. The disease can destroy the hip joint; therefore, hip replacement has a critical management role.[1] Total hip replacement, or total hip arthroplasty (THA), is surgery to replace the damaged hip joint (both cartilage and bone) with an artificial joint. The demand for hip replacement is rising with an aging population, increasing rates of obesity and osteoarthritis, expanding surgical indications, and a greater awareness of the favourable outcomes that can result from the procedure.[1,2]

There is a fear that increased demand may overwhelm available health care resources.[3] As demand rises, resources must be used optimally within the limits of patient safety, and this includes minimizing hospital length of stay.[4,5] In addition, some active patients want to regain their independence quickly.[6] To reduce the time spent in the hospital, outpatient (or same-day) THA has been shown to be successful. For carefully selected patients, the use of newly developed care protocols can allow them to have surgery and be discharged on the same day instead of spending an average of four days in hospital.[1,7-12]

The Technology

A combination of factors is key to successfully achieving outpatient THA, with a multidisciplinary team-based approach being essential:[13]

- *Careful patient selection* — Patients are carefully selected (e.g., younger, thinner, and healthier) and must have adequate home support available.[14]
- *Preoperative education* — Education can be individual or in groups and may involve input from internal medicine, anesthesiology, nursing, and physiotherapy.[13]
- *Perioperative pain management and anesthesia techniques* — This includes multimodal and preventive analgesia (potentially including preoperative medications), combinations of general and regional anesthesia, and the minimal use of narcotics.[14,15]

In particular, effective management of post-operative pain requires that there are no gaps in, or periods of, inadequate pain control.[16]

- *Surgical techniques* — Advanced surgical techniques limit muscle damage[5] and blood loss, the latter sometimes requiring topical or intravenous tranexamic acid (an antifibrinolytic medicine used to prevent heavy bleeding).[14,15] Additional strategies minimize fluid overload and orthostatic hypotension, and maximize motor function.[13]
- *Strict discharge criteria* — An assessment of discharge readiness after an outpatient THA must include factors such as medical, functional, and wound status, while also ensuring that the regular standard-of-care discharge criteria of an institution are not compromised.[17]
- *A multidisciplinary approach to post-operative management* — The focus is on avoiding the use of tubes and catheters, and providing deep vein thrombosis prophylaxis, early feeding, and intensive physiotherapy for rapid mobilization.[5,13]

The Canadian Joint Replacement Registry reports that in 2013-2014, there were close to 50,000 hospitalizations for THAs in Canada. Median length of stay was four days.

With respect to how the surgery is performed, the anterior approach is generally considered to be optimal because it is less invasive, leaving muscle and tendon attachments preserved and the posterior joint capsule intact;[12] however, this approach can involve a significant learning curve.[6,18] In addition, a costly, dedicated surgical table may be required to facilitate femoral exposure and intraoperative imaging.[6] Several systematic reviews of THA surgical approaches examined the advantages and disadvantages of the anterior approach for primary THA in comparison with other approaches; one found the anterior approach to be superior with respect to post-operative recovery and the need for assistive devices,[18] while the other found the anterior approach was associated with shorter length of stay, greater functional rehabilitation, and lower immediate post-operative pain, although longer surgical duration.[19] More recent studies from Quebec and New York compared outcomes for anterior and posterior approaches and reported complication rates that were low and comparable.[20,21]

Pain control is a major consideration with this surgery, and many preparatory, surgical, and rehabilitation strategies are used to reduce pain. Perioperative pain can be managed with multimodal analgesia, which provides adequate pain relief immediately after surgery, while also allowing patients to become mobile sooner and discharged earlier.[22,23] This can include the injection of a long-acting local anesthetic into surgical openings before wound closure.[24-26] Evidence has shown earlier mobilization and reduced length of hospital stay with this strategy, as well as lower rates of pain at 24 hours and 48 hours after commencing activity, reduced opioid consumption, and less vomiting.[26]

Regulatory Status

Surgical procedures do not require Health Canada licensing.

Patient Group

Surgical rates are rapidly increasing: the Canadian Joint Replacement Registry report for 2015 reported that, in the one-year period of 2013-2014, there were close to 50,000 hospitalizations for THAs in Canada — a one-year increase of 5%.[27] Women have 58% of the surgeries and tend to be older at the time of surgery (average age 72 years versus 68 years for men).[27] Of all primary THAs, 75% result from a diagnosis of osteoarthritis, and 15% resulting from a hip fracture.[27] Studies on outpatient THA have generally been restricted to a select patient group to minimize the likelihood of complications or protracted hospital stay, although ultimately the most suitable patient group is still being explored. Patient characteristics associated with longer lengths of stay after THA have included an American Society of Anaesthesiologists (ASA) score greater than 2 (i.e., more comorbidities)[28] and the presence of cardiovascular disease or lung disease.[29]

Additional characteristics for longer lengths of stay described by researchers include: older age, increased body mass index (BMI), female gender, and liver cirrhosis.[30,31] (However, the relationship of patient BMI to morbidity and length of stay in "fast track" THA — length of stay of three days or fewer — has been called into question by a Danish study, with the exception of patients with a BMI of 35 or greater.[32])

Current Practice

In a THA, the femoral head and damaged acetabulum are removed and replaced with metal, plastic, or ceramic components.[1] The most common surgical approaches are lateral and posterior; these involve tissue disruption with respect to muscles and the joint capsule, and can lead to complications such as subsequent joint dislocation.[1,12] In Canada in the one-year period of 2013-2014, the median length of stay for THA was four days.[1] Minimally invasive hip surgery has been used for selected patients to decrease tissue injury and blood loss.[27]

The Evidence

The evidence includes a 2016 systematic review,[5] with a literature search that ended in late 2014, and seven more recent studies: two randomized controlled trials (RCTs)[7,12] and five observational studies[8-11,30] (Tables 1 and 2). The research was carried out in Canada, Denmark, the Netherlands, and the US. Three prospective cohort studies are currently underway: two in Canada[33] and one in Denmark[34] (Table 3). The findings are as follows:

- The systematic review of clinical and economic literature identified nine relevant studies, none of which was an RCT (Table 1).[5] Across studies, various surgical approaches and anesthesiology techniques were used. Seven studies restricted patient selection based on factors such as age, BMI, and comorbidities, although two enrolled unselected populations (a more useful assessment of effectiveness because of a broader generalizability of the findings). The studies were assessed to be generally of low quality. For clinical outcomes, function was assessed via scores such as the Harris Hip Score (HHS) and the Short Form Health Survey (SF-12). The conclusion was that outpatient THA can be safely performed in selected patients. Two economic analyses reported lower costs for outpatient compared with in-patient care. The systematic review authors concluded that, "[d]espite a lack of high-level evidence, our review of the literature demonstrated that [outpatient] procedures result in similar complication rates and clinical outcomes, while substantially minimizing the cost, in comparison with [in-patient] procedures," although they noted a need for more rigorous and adequately powered RCTs.[5] (Note that the authors defined outpatient surgery as discharge within 24 hours after surgery; i.e., this could have included an overnight stay in hospital. This outpatient definition issue has been explored by others who have noted that patients kept in overnight are still sometimes defined as outpatients.[35])
- The RCTs were published in 2016 and include a US study published in a peer-reviewed journal[7] and a Canadian graduate school thesis[12] (Table 1). Both RCTs randomized patients to THA by the anterior approach as outpatients (discharge the day of surgery) or in-patients. The first RCT used spinal anesthesia[7] and the second used general anesthesia.[12]
  - The US study[7] followed 220 patients (112 outpatients and 108 in-patients) for four weeks, and assessed post-operative pain, perioperative complications, function via the HHS, health care provider visits (readmission, emergency room, or surgeon office visits), and relative work effort for surgeons' office staff. Outcomes did not significantly differ between study arms, except there was a higher mean, post-operative, day one, pain level for the outpatient group. In each study arm, approximately 25% of patients were not discharged as planned. In the outpatient group (n = 112), 26 patients stayed one night and one patient stayed two nights. In the in-patient group (n = 108), 18 patients left on the day of surgery and nine stayed two or more nights.
  - The Canadian study[12] enrolled 95 patients, but three-month results were available only for the first 45 patients (23 outpatients and 22 in-patients). The primary outcome measure was serious adverse events, with secondary outcomes being patient satisfaction, functional outcomes, quality of life, pain, extent of assistance provided by a caregiver, and cost. Results showed no statistically significant differences in any outcomes except cost, where outpatient care was provided at a significantly lower cost from the hospital and Ministry of Health perspectives. However, costs were not significantly lower when estimated from a societal perspective that included patients' out-of-pocket costs, time for appointments, time off work, and caregiver time.
- Of the four observational studies (Table 2), one was a retrospective chart review at an ambulatory surgical centre[11] and three were prospective cohort studies.[8-10] Two of the

Table 1: Characteristics and Findings of the Systematic Review and Two RCTs for Outpatient Total Hip Arthroplasty

Systematic Review					
First Author (Year), Country	**Types and Number of Primary Studies**	**Population Numbers**	**Intervention**	**Follow-up and Clinical Outcomes Tracked**	**Findings**
Pollock et al. (2016), Canada[5]	9 studies: 2 case-control and 7 case series. Literature search ended November 2014 (English language only). Study publication dates 2003 to 2013.	Comparative studies: OP 129 pts vs. IP 88 pts. Case series: 984 pts (range 53 to 295 pts).	THA using various techniques (including DAA, anterolateral, posterolateral, and posterior).	Comparative studies = 1 year; case series = 3 months to 1 year. Outcomes: complications, readmissions, revisions, satisfaction, pain scores, functional data, HHS, LOS, cost.	• OP (vs. IP) THA can be safely performed in selected patients. • Costs of hospital care were lower for OP THA (2 studies); i.e., a 2005 Utah study reported costs for OP as US$2,500 lower than IP care; and a 2014 Pennsylvania study reported costs of US$24,529 for OP versus US$31,327 for IP care ($P < 0.001$). • Pt satisfaction (2 studies): ~ 95% of patients would have the same surgery again or recommend it to others.
Randomized Controlled Trials					
First Author (Year), Country	**Study Design and Study Exclusions**	**Patient Characteristics**	**Intervention and Comparator**	**Follow-up and Clinical Outcomes Tracked**	**Findings**
Goyal et al. (2017), US[7]	Prospective study at two high-volume, adult THA centres in Virginia and Pennsylvania, 2014-2015. Study exclusions: age 75+; BMI > 40 kg/m^2; use of walker or chronic opioids.	n = 220 (112 OP and 108 IP); 47% women, mean age 60 ± 8.7 years (range 37 to 79), mean BMI = 27.9 ± 4.4, preoperative diagnosis 94% OA (NSD between arms).	THA by DAA under spinal anesthesia; OP (< 12 hour hospital stay) vs. IP (overnight stay).	Follow-up = 4 weeks. Outcomes = post-operative pain; peri-operative complications; HHS; health care provider visits (readmission, ER, or surgeon office); relative work effort for surgeons' office staff.	• No losses to follow-up in the study. • The only difference in outcomes between groups was a higher mean post-operative day 1 pain level for OP group: VAS OP 3.7 ± 2.3 vs. IP 2.8 ± 2.1, MD 0.9, 95% CI, 0.3 to 1.5, $P = 0.005$. • AEs: NSD.

Randomized Controlled Trials (cont'd)					
First Author (Year), Country	**Study Design and Study Exclusions**	**Patient Characteristics**	**Intervention and Comparator**	**Follow-up and Clinical Outcomes Tracked**	**Findings**
					• In each study arm, ~25% of pts were not discharged as planned: – OP arm: 26 patients stayed 1 night, 1 patient stayed 2 nights (reasons = dizziness/ hypotension, pain, patient preference, nausea, ambulatory dysfunction, urinary retention). – IP arm: 18 patients left the day of surgery, 9 stayed ≥ 2 nights.
Pollock (2016), Canada[12] (Study enrolled 95 pts but only 45 completed 3-month follow-up by time of analysis)	Prospective study at one centre, 2015-2016; patients blinded about being in a study. Study exclusions: multiple including obesity and inadequate care at home.	n = 45 (22 OP and 23 IP); 44% women, mean age 61 years (range 27 to 74), mean BMI = 27, 25% had previous joint replacement.	THA by DAA under general anesthesia; OP (same day) vs. IP (overnight stay).	Follow-up = 3 months. Outcomes = Primary was SAEs; secondary were patient satisfaction, functional outcomes, QoL, pain, cost (hospital, MoH, and societal), extent of assistance provided by a caregiver.	• Mean LOS (hours) [IQR]: OP 8.4 [1.1], IP 29.1 [6.0]. • 1 SAE in each group: OP was error in analgesia, IP was deep infection. • Costs: OP significantly lower cost from hospital and MoH perspectives but not a societal perspective (included OOP costs, time for appointments, time off work, caregiver time, etc.). • NSD was found for any other outcome measures.

AE = adverse event; BMI = body mass index; CI = confidence interval; DAA = direct anterior approach; ER = emergency room; HHS = Harrison Hip Score; LOS = length of stay; IP = in-patient; IQR = interquartile range; LOS = length of stay; MD = mean difference; MoH = Ministry of Health; NSD = no statistically significant difference; OA = osteoarthritis; OOP = out-of-pocket; OP = outpatient; pt = patient; QoL = quality of life; RCT = randomized controlled trial; SAE = serious adverse event; THA = total hip arthroplasty; VAS = visual analogue scale; vs. = versus.

Table 2: Characteristics and Findings of Observational Studies for Outpatient Total Hip Arthroplasty

First Author (Year), Country	Study Design and Study Exclusions	Patient Characteristics	Intervention	Follow-up and Clinical Outcomes Tracked	Findings
Bendikas and Skovgaard (2015), Denmark[9] [conference abstract]	Prospective cohort study. Exclusions NR.	n = 20. Pt characteristics NR.	THA (details NR).	3 months. Outcomes = anxiety, depression, self-confidence, health status, complications, AEs.	• High degree of patient satisfaction (not quantitated). • 17 of 20 pts (85%) discharged the day of surgery, 2 discharged next day, 1 discharged 2 days later (reasons NR). • AEs: None reported.
Coenders et al. (2016), Netherlands[8] [conference abstract]	Prospective cohort study. Exclusions: DM, CVD, no caretaker, motivation issues.	n = 113. Mean age 62 years (range 42 to 78), mean BMI 27 (range 20 to 35).	THA (details NR).	12 months. Outcomes = health status, pain and function using 4 different scales/tools, complications, AEs.	• All pain and function scales improved "significantly" (details NR). • 100 of 113 pts (88%) discharged the day of surgery, 13 discharged next day, mainly due to nausea and dizziness. • AEs: One readmission for superficial wound infection, otherwise "no troublesome side effects or re-operations."
Parcells et al. (2016), USA[11]	Retrospective chart review at an ASC. Pt exclusions: major CVD, TE disease, cardiac arrhythmias.	n = 22; 45% women, mean age 60 years, mean BMI 28.7; mean ASA Class II.	THA by DAA (regular OR table) with epidural anesthesia before surgery and general anesthesia.	14.9 months (minimum 3 months). Outcomes = AEs, pt satisfaction.	• Pt satisfaction NR separately for THA pts (study also included TKAs) but reported 80% satisfaction with the care model. • 21 of 22 pts (95%) went home the day of surgery (mean LOS 6.25 hours); 1 pt discharged to a rehabilitation facility (preoperative decision). • AEs: 6 of 22 pts (27%) had post-operative nausea that responded to medication and did not delay discharge, 1 pt suffered an atraumatic hip fracture 3 weeks over surgery (healed well).
Den Hartog et al. (2015), Netherlands[10]	Prospective cohort. Pt exclusions: CVD, insulin-dependent DM, no caregiver, ASA score > 2.	n = 27; 56% women, mean age 63 years (range 48 to 71), mean BMI 26; 56% were ASA Class I.	THA by anterior supine intermuscular approach under spinal anesthesia.	3 months. Outcomes = PROMs (3 scales for function and pain), AEs, readmissions.	• PROMs (function and pain) improved significantly. • 24 of 27 pts (89%) discharged day of surgery, 2 discharged next day, and 1 after 2 days, primarily due to dizziness/nausea. • AEs: 1 readmission on day 11 due to a seroma (accumulation of fluid near the surgical wound).

AE = adverse event; ASA = American Society of Anesthesiologists; ASC = ambulatory surgical centre; BMI = body mass index; CPAP=continuous positive airway pressure; CVD = cardiovascular disease; DAA = direct anterior approach; DM = diabetes mellitus; LOS = length of stay; NR = not reported; NSQIP = National Surgical Quality Improvement Program; OP = outpatient; OR = operating room; PROM = patient-reported outcome measure; pt = patient; TE = thromboembolic; THA = total hip arthroplasty; TKA = total knee arthroplasty; UKA=unicompartmental knee arthroplasty.

Table 3: Characteristics of Ongoing Studies for Outpatient Total Hip Arthroplasty (From ClinicalTrials.gov)

Clinical Trial Number, Country (Lead Investigator)	Study Design and Study Exclusions	Patient Characteristics	Intervention	Follow-up and Clinical Outcomes Tracked	Findings
NCT02544620, Denmark[34] (Dr. Kirill Gromov, Hvidovre Hospital)	Prospective cohort feasibility study of unselected pts.	n = goal of 1,500 pts for primary surgery including those for TKA and UKA, ASA Class I or II. Exclusion: sleep apnea using CPAP.	THA (details NR).	3 months. Outcomes = PROMs, patient satisfaction, complications, AEs, readmissions.	• Study started enrolment September 2015. • Estimated primary completion date: August 2017 (final data collection date for primary outcome measure). • Estimated study completion date December 2017.
NCT03028779, in process, Canada (Montreal)[37] (Dr. Pascal-André Vendittoli Université de Montréal / Hôpital Maisonneuve-Rosemont, Montréal, QC: personal communication, 2017 Jan. 29)	Prospective cohort study with 174 historical controls who had had the standard procedure in the previous 3 years.	n = goal of 150 pts for primary surgery including TKA; require adequate at-home support for 1 week after surgery. Exclusions: BMI > 40, multiple medical conditions listed, live > 50 km from surgical centre.	THA via a posterolateral approach. Anesthesia as per an established protocol.	12 months. Outcomes = AEs, cost, LOS, blood loss, patient function and experience using the HOOS score & SF-36.	• Study started enrolment August 2016 (then had a 3-month break due to issues related to Health Canada approvals for use of drugs off-label). • Estimated study completion date late 2018.
NCT03026764, Canada (London)[36] (Dr. Brent Lanting, London Health Sciences Centre)	Randomized study comparing standard IP THA with same-day discharge THA.	n = goal of 750 pts, ages 18 to 90 years, ASA Class ≤ III, English language competence, located within a 60-minute drive, sufficient caregiver support. Exclusions: previous THA; pain management, anesthetic, psychosocial, or cognitive issues; obesity limiting movement.	THA (details NR).	3 months. Outcomes = cost, early complications and AEs, standardized measure of health outcome (EQ-5D), WOMAC score, HHS, SF-12, pain numerical rating scale, caregiver assistance scale, patient satisfaction.	• Study started in May 2015; this is a continuation of the Pollock study.[12] • Estimated study completion date July 2018 • The researchers believe this will be the first level 1 study to investigate the cost, early complications, and patient satisfaction associated with outpatient THA in a pragmatic selection of patients.

AE = adverse event; ASA = American Society of Anesthesiologists; BMI = body mass index; CPAP = continuous positive airway pressure; EQ-5D = EuroQol 5-Dimensions questionnaire; HHS=Harris Hip Score; HOOS= Hip disability and Osteoarthritis Outcome Score; IP = in-patient; LOS = length of stay; NR = not reported; OP = outpatient; PROM = patient-reported outcome measure; pt = patient; SF-12 = Short Form (12) Health Survey; SF-36 = Short Form (36) Health Survey; THA = total hip arthroplasty; TKA = total knee arthroplasty; UKA = unicompartmental knee arthroplasty; WOMAC= Western Ontario McMaster Osteoarthritis Index.

latter studies were reported in conference abstracts, so information was sparse.[8,9] Study enrolment ranged from 20 to 113 patients. The two abstracts did not provide details on the surgical or anesthesia approaches; the others used anterior surgical approaches.[10,11] The ambulatory surgical centre study used epidural anesthesia[11] and the other studies used spinal anesthesia.[10] Follow-up ranged from three to about 15 months. All studies reported a successful discharge of most of the patients (85% to 95%) on the day of surgery; patients who stayed an extra day mainly did so due to nausea and/or dizziness. Rates of adverse events were low, and all studies reported high levels of patient-reported outcome measures (PROMs) and/or patient satisfaction.

- Three prospective studies are currently underway in Denmark[34] and Canada (Montreal[33] and London[36]) (Table 3).
  - The Danish study will evaluate patients who meet discharge criteria on the day of the surgery, with a focus on safety and patient satisfaction.[34] A broad group of patients will be enrolled, with the only exclusions being patients in ASA Classes I and ASA Class II (i.e., absence of, or mild, systemic disease), and the absence of sleep apnea. Details about the surgical and anesthetic techniques are not available. The study is expected to be completed in December 2017.
  - A study of THA and total knee arthroplasty (TKA) has recently been launched in Montreal.[33] For THA, this study will compare outpatient surgery via a posterolateral, with traditional THA surgeries performed over the previous three years (Dr. Pascal-André Vendittoli, Université de Montréal / Hôpital Maisonneuve-Rosemont, Montréal, QC: personal communication, 2017 Jan. 29). The goal is to recruit 150 selected patients for THA and TKA. Excluded are: patients with a BMI greater than 40, those with multiple medical conditions, those living more than 50 km from the site of surgery, and those without caregiver help at home for a week after surgery. A detailed protocol has been developed including anesthesia care. Follow-up will extend to 12 months, with multiple outcomes tracked such as adverse events, length of stay, and patient function and experience. The study is expected to end in late 2018.
  - A randomized study in London, Ontario, is comparing standard, primary in-patient THA with same-day discharge THA.[36] The study began in May 2015 and is still recruiting patients, with a goal of 750 to be enrolled. This study is a continuation of the smaller study described by Pollock (2016)[12] and is accepting adults aged 18 to 90 years with an ASA Class of III or less. A specific surgical or anesthetic approach is not described. In addition to tracking functional outcomes, the study will track costs from the perspectives of funder, institution, patient, and society; patient satisfaction; and caregiver experience. Follow-up will be three months, with the study completing in July 2018.

Safety

In the systematic review of nine studies, adverse events were categorized as acute (intraoperative or immediately perioperative) or post-discharge.[5] Rates of acute adverse events ranged from 0% (in three of nine studies) to 25%. The most common were nausea/dizziness (up to 10%), hypotension (up to 9%), and over-sedation (5%), with rates of 3% or lower for pain, fracture, wound infection, and pulmonary embolism. Rates of post-discharge adverse events ranged from 0% (three studies) to 7%, with one study reporting a 5% readmission rate. Other adverse events appeared at rates of 2% or lower including dislocation, fracture, deep vein thrombosis, infection, revision, and gastrointestinal issues. The two RCTs[7,12] reported no significant difference in rates of adverse events between study arms. The observational studies[8-11] reported nausea and/or dizziness in up to 27% of patients whose discharge was delayed in a few cases, but other adverse events were not common.

A retrospective review of the 2005-2014 American College of Surgeons National Surgical Quality Improvement Program (NSQIP) looked at adverse events for THA patients categorized as outpatients (length of stay = zero days) versus in-patients (length of stay = one to five days).[38] Of 63,844 patients identified, 420 (0.7%) had surgery as outpatients; they tended to be younger (median age of 62 versus 65 years) and male (53% versus 45%), with lower ASA scores. Results showed that rates of readmission and the 18 adverse events tracked by NSQIP were no different for outpatients than in-patients (other than for blood transfusion, which was lower for outpatients). A similar study of the NSQIP data for 169,406 THAs and TKAs over the same time period also showed that outpatient THA or TKA alone did not increase the risk of readmission or reoperation, and showed fewer complications.[39] In both reviews, the authors concluded that outpatient THA can be a safe operation in appropriately selected patients.[38,39]

A literature review of conventional THA reported that rates of complications within 90 days after surgery were: hospital readmission (4.6%), hip dislocation (3.1%), mortality (1.0%), pulmonary embolus (0.9%), and wound infection (0.2%).[27] A US study reported that opioid-related adverse events were significant and affected both the length of stay and the likelihood of discharge to extended care facilities.[40] Among 673 THAs and TKAs, the incidence of opioid-related adverse events was 8.5%, which accounted for 58% of all post-operative complications.[40]

Administration and Cost

Health care cost savings can be achieved if several post-operative hospital days are avoided, without sacrificing safety or quality of care.[4,6,30,41] In terms of cost to society, a 2015 Canadian economic analysis noted that currently 95% of osteoarthritis hospitalization costs are due to THA and TKA surgeries.[2] A projection to 2031 estimated that the hospitalization costs of these surgeries would increase almost four-fold, from $720 million to almost $2.8 billion, with similar doubling or tripling of costs for physicians, prescription drugs (including the costs of drug-related adverse events), and patient out-of-pocket costs.[2]

The recent Canadian RCT[12] tracked outpatient versus in-patient costs for THA in London, Ontario. Cost-minimization analyses showed the outpatient group was significantly less expensive from the perspectives of the hospital ($5,170 versus $4,403)and the Ministry of Health ($6,752 versus $5,890), primarily because of a shorter length of stay, less time in the post-anesthetic recovery unit, and less time following discharge from the recovery unit. There was no statistically significant difference between groups from a societal perspective ($12,793 versus $14,483) The study authors hypothesized that this finding may have been due to the small sample size, as the groups differed in several relevant ways. For example, more patients in the outpatient group were employed full-time and more patients in this group took three months off of paid employment post-operatively.

In the systematic review,[5] economic analyses were reported for two of the nine included studies:

- a 2005 Utah study reported outpatient costs as US$2,500 lower than that for in-patients
- a 2014 Pennsylvania study reported costs of US$24,529 ± $1,759 for outpatient versus US$31,327 ± $9,013 for in-patient care ($P < 0.001$) based on final patient billing records (including the costs for four patients who required readmission).

An economic analysis from Maryland compared the hospital costs for a same-day versus a two-day length of stay based on 273 THAs from April 2014 to January 2015.[30] The hospital cost-accounting system reported that patients with a two-day stay cost about US$2,900 more than patients with a one-day stay. This was distributed across services as follows: bedside nursing care (44%), medical supplies (36%), in-patient rehabilitation (10%), laboratory tests (5%), medical and surgical hospitalists (4%), and drugs (1%).

Regarding increasing lengths of stay, a retrospective study noted that the perioperative surgical variables that correlated with an increased length of stay were surgery start time after noon, the use of general anesthesia, a posterolateral surgical approach, increased operative time, increased blood loss, and patients who were not ambulatory on the day of surgery.[30]

A Canadian study of various THA surgical approaches (anterior, lateral, and posterior) in 120 patients reported that the preoperative Timed Up and Go (TUG) test predicted the patients who would have a length of stay of more than 48 hours.[42] (In the TUG test, a patient sits in a chair with armrests and on the word "go" walks to a three-metre mark, turns, returns to the chair, and sits down.) For every five-second interval increase in TUG time, patients were twice as likely to stay in hospital beyond 48 hours. In contrast, patient age (range was 42 to 92 years), BMI (range was 16.2 to 39.9), Charlson Comorbidity Index (a method of categorizing comorbidities), mean procedure time, and mean time in the post-anesthetic care unit were not predictive of increased length of stay.

Concurrent Developments

Length of stay for THA has been decreasing in recent years, as have literature reports on rapid recovery ("fast track") protocols that shorten hospital stays, but these stays are not as short as discharge the day of surgery.[43-47] For example, a retrospective Dutch cohort study with 1,180 unselected patients reported that the introduction of a rapid recovery protocol led to a drop in mean length of stay from 4.6 to 2.9 days, with no statistically significant differences in the rates of complications, readmissions, or re-operations.[46]

Similarly, robotic arm surgery has been used to reduce hospital stay. A report from the American Hip Institute described THA for selected patients (those with poorly controlled medical comorbidities were excluded) using robotic surgery at a dedicated surgical outpatient centre in combination with a tissue-preserving surgical approach (anterior or posterior), multimodal pain and nausea management, careful blood management, early rehabilitation, home care for one to two weeks, and physiotherapy for six to eight weeks.[48]

Rate of Technology of Diffusion

Discharge on the day of THA surgery is not new — the first report of same-day discharge was published in 2003 by an orthopedic group in Chicago;[49] however, an increasing number of publications present data on recent experiences in North America and Europe.

Implementation Issues

Economic analyses show this approach to be resource-saving, and patient experience is overwhelmingly positive. However, study populations have been highly selected, with restrictions on age, BMI, and severity of comorbidities, and are not representative of the general population receiving THAs. For example, study populations have been in the range of 54 to 63 years of age, whereas the mean age for THA is 68.[5] Expansion of patient eligibility, as well as establishment of local protocols to ensure safety, could lead to a wider dissemination of same-day THA surgery.

Launching same-day THA programs requires locally developed, multidisciplinary care protocols that detail the many steps required to maximize success; for example, patient and family education, suitable anesthesia and analgesia to minimize pain and nausea, advanced surgical techniques with minimal blood loss, early mobilization, strict discharge criteria, and a supportive home environment.[14] It is essential to note the importance of the multidisciplinary team, and the challenges involved in getting team members working toward the same goal (Dr. Pascal-André Vendittoli: personal communication, 2017 Jan 29). Special anesthetic procedures may be required, and regulatory approval to use some drugs off-label has caused delays in implementation in the Montreal program. Based on local orthopedic practices, decisions about which surgical approaches to use may be needed. In the Montreal example, the team decided to stay with the posterior approach because the surgeons were most familiar with it and this would avoid a training learning curve and special equipment, as well as longer operating times. Maintaining the current THA surgical approach could make the procedure easier to introduce in lower-volume surgical centres.

Final Remarks

There is considerable interest in outpatient THA because of its potential to improve quality of care and reduce health care costs. The idea of being discharged from hospital on the same day as the procedure, if feeling well enough to comfortably do so, is appealing to many patients. A better understanding of the appropriate patients for this procedure (based on studies currently ongoing) will allow providers, administrators, and decision-makers to better assess the potential value for their jurisdictions.

Methods — Literature Search Strategy

A peer-reviewed literature search was conducted using MEDLINE, PubMed, Embase, and the Cochrane Library. Grey literature was identified by searching relevant sections of the *Grey Matters* checklist (https://www.cadth.ca/grey-matters), and through clinical experts. No methodological filters were applied. The search was limited to English-language documents published between January 1, 2011, and November 25, 2016. Regular alerts were established to update the search until January 30, 2017. Conference abstracts from the last two years were included in the search results.

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