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Outcomes of Total Hip Arthroplasty in Spastic Patients

Hassan Alosh, MD, Atul F. Kamath, MD, Keith D. Baldwin, MD/MPH, MaryAnn Keenan, MD, Gwo-Chin Lee, MD

Department of Orthopaedic Surgery, University of Pennsylvania, Philadelphia, Pennsylvania

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ABSTRACT

Patients with spasticity and hip arthritis can present challenges to treatment. This investigation evaluated the effectiveness and safety of THA in patients with upper motor neuron disease. Twenty-seven consecutive patients with history of cerebral palsy (CP) or acquired spasticity (AS) underwent 30 THAs for treatment of hip arthritis. They were followed for an average 2.5 years (range 2.1–12.1). Patients with CP were more likely to require hip adductor release and hip flexor lengthening at the time of THA. Statistically significant improvements were made in Harris Hip Scores, pain scores, range of motion, ambulatory status, and the use ambulatory-assistive devices. There were no dislocations in this group. Patients with spasticity can benefit from THA in terms of pain relief and improved mobility with relatively low complications.

The prevalence of neurologic disorders in the general population is increasing. In the past 30 years, mortality from stroke has decreased by nearly 70% [1]. Meanwhile, its incidence in the young adult population has steadily increased, suggesting a longer lifetime burden of neurologic disease [2]. Greater longevity and functional status after a neurologic insult also means that these patients will have greater expectations for quality of life and mobility. Within the general population, the projected demand for total hip arthroplasty (THA) is estimated to increase by over 170% within the next 20 years, and the rate of revision THA is expected to double during this period [3]. This rapid rise will likely be mirrored in the people afflicted with neurologic disorders.

Limited data exist regarding patient outcomes and perioperative protocols for the spastic patient undergoing primary THA. Furthermore, recognizing the broad spectrum of neurologic conditions, these patients may present with specific contractures and gait disturbances that needs to be carefully evaluated and considered during the preoperative and postoperative periods. Finally, concerns with hip instability, rehabilitation potential, and questions about realistic improvements in function following arthroplasty remain.

Therefore the purposes of this study are to (1) evaluate the effectiveness and outcomes of patients with spasticity and coxarthrosis undergoing primary THA and (2) determine if differences exist among patients with cerebral palsy and those with acquired spasticity when undergoing THA.

Methods

We retrospectively reviewed the medical records of 29 consecutive patients with spasticity who underwent primary THA by one of the senior authors (MAK or GCL) at our institution between 1993 and 2011. This study was approved and conducted according to the guidelines set forth by our institutional review board (IRB). All patients had a confirmed diagnosis of upper motor neuron (UMN) disorder including cerebral palsy (CP) or acquired causes such as traumatic brain injury (TBI), cerebrovascular accident (CVA), spinal cord injury (SCI), or multiple sclerosis (MS). Motor control was graded using a clinical scale [4]. In this scale, an extremity can be hypotonic (Grade 1) or rigid (Grade 2) without any volitional movement. The extremity may exhibit mass flexion or extension patterned movement. This can be reflexive (Grade 3) or volitional (Grade 4). Motor control can be selective with pattern overlay (Grade 5), meaning movement of the hip joint with minimal movement of the adjacent joints, or Grade 6 volitional, allowing movement of a single joint independent of movement in the adjacent joints. Motor strength was graded on a standard 0 to 5 scale, with 0/5 exhibiting no contraction, 3/5 demonstrating movement against gravity, and 5/5 exhibiting full motor strength.

Preoperative Evaluation

All patients were evaluated preoperatively and after surgery using a detailed, standardized format. Inclusion criteria included all patients between ages 25 and 80 with end-stage degenerative hip disease, an upper motor neuron disorder, and the ability to perform transfers and maintain an upright sitting posture. Patients with Grade 4 or greater motor control, in addition to Grade 3 or greater motor strength of the hip abductors and flexors, were deemed eligible for THA. Static

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Reprint requests: Gwo-chin Lee, MD, Department of Orthopaedic Surgery, Presbytarian Hospital, University of Pennsylvania, 51 N 39th St, 1 Cupp Building, Philadelphia, PA 19104.

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deformities were differentiated from dynamic deformities with a pharmacologic block when necessary. Hip range of motion and deformity was determined with use of a goniometer before and after surgery. Fixed hip flexion and adduction contractures were determined preoperatively as described in previous studies [5,6]. Prior to surgery, patients and their families were extensively counseled and informed of the inherent risks of THA; in particular, infection, dislocation, neurologic injury, postoperative pulmonary and cardiac complications, and recurrent heterotopic ossification.

Pain score were documented on 0–10 visual analogue scale. The use of assistive devices for ambulation was noted. Ambulatory status was also classified on a 0–5 scale: Level 0 (unable), 1 (nonfunctional), 2 (independent household), 3 (independent neighborhood), 4 (independent community), and 5 (normal). The modified Ashworth scale was used to classify spasticity via resistance to passive movement [7]. In this scale, 0 means no increase in tone, 1 means slight increase in tone, 2 means more marked increase in tone with the limb easily flexed, 3 means considerable increase in tone with difficult movement of the limb, and 4 is severe spasticity with a rigid limb. Antero-posterior radiographs of the pelvis and hip and cross-table lateral projections of the hip were obtained preoperatively to confirm degenerative disease and the presence of heterotopic ossification (HO). Patients with severe spasticity (Ashworth 3 or 4) were referred to the Physiatry service for selective pharmacologic blockade (either phenol or botulinum toxin). In this series, 14 patients (16 hips) who had Ashworth spasticity scores of 3 or greater and underwent pharmacological blockade procedures at a range of 2–3 weeks preoperatively. All patients who underwent these procedures improved their spasticity to an Ashworth score of 1 or 2 on the day of surgery. Improvements in range of motion was calculated by comparing the joint range of motion at last follow-up to the joint range of motion upon initial patient presentation prior to any selective injections. Data to compute Harris Hip Scores (HHS) was collected prospectively [8].

Surgical Technique

All arthroplasties were performed using a standard posterolateral approach to the hip with the patient positioned in a lateral decubitus position. All patients underwent general anesthesia in order to achieve complete muscle paralysis. Uncemented, press-fit femoral and acetabular components were utilized in all patients. To minimize the effects of surgery in patients with muscle and gait dysfunction, the abductors were carefully protected. A modular femoral component was employed in cases of severe femur dysplasia ($n = 3$). Femoral head autograft or metallic augments were used to achieve adequate hip coverage in circumstances of acetabular dysplasia ($n = 2$). A constrained liner was used in two cases when abductor deficiency was encountered during THA. In all cases, the posterior hip capsule and short external rotators were repaired to minimize the risk of hip dislocation. Concomitant excision of heteropic bone (HO) was performed in 7 cases. These patients received a single dose of radiation up to postoperative day 3 and were given 75 mg indomethacin daily for an additional 4 weeks postoperatively to prophylax against recurrent heterotopic ossification. Additionally, soft tissue releases such as adductor tenotomy ($n = 11$) and iliopsoas lengthening ($n = 6$) were performed for patients with preoperative contractures. Patients with adduction contractures greater than 15° and flexion contractures greater than 30° under anesthesia underwent soft tissue release at the time of surgery. Patients with an equinovarus deformity of the foot ($n = 6$) had an Achilles lengthening and split tibialis anterior tendon transfer (SPLATT) performed preoperatively to achieve a plantigrade foot prior to THA. The median femoral component head size was 32 mm (range 22–32).

Postoperative Management

Patients were managed aggressively with analgesics and muscle relaxants to minimize spasticity and maximize patient comfort during the postoperative period. A multidisciplinary approach including consultation with Physiatry and Pain Management was used in all cases. All patients in this series were placed in an abduction pillow and knee immobilizer postoperatively. Furthermore, patients with cognitive impairments and anticipated difficulty following hip precautions were placed in an abduction brace for a minimum of 6 weeks ($n = 5$). All patients were mobilized by physical therapy on postoperative day 1. All patients were discharged to a rehabilitation facility for additional physical and occupational therapies. Postoperative rehabilitation focused on strict maintenance of posterior hip precautions, achieving a stable gait pattern with a minimal degree of assistive devices, and stretching programs tailored to a patients prior or concomitant corrective procedures (eg, maintaining a plantargrade foot after a split tibialis tendon transfer). Furthermore, in coordination with the rehabilitation and the prosthetic services, necessary modifications to ambulatory-assistive devices were addressed in patients who also suffered from upper extremity spasticity and deformities.

Follow-Up Data

Patient medical records were reviewed for the major and minor outcomes of interest. Main outcomes of interest were improvement in ambulation status, subjective pain scores, and complications. Secondary outcomes included Harris Hip Scores, preoperative deformity, range of motion (ROM), and additional procedures performed during or in preparation for THA.

Statistics

Because the data were not normally distributed, the Wilcoxon Signed Rank test was used to determine significant differences in preoperative and postoperative ROM, pain scores, and Harris Hip Scores. In cases comparing proportions between the CP and AS cohorts, the chi-squared test with Yate's correction was used. Statistical significance was assigned at $P \leq 0.05$. Statistics were performed used the Excel 2010 (Microsoft, Redmond, WA, USA) and STATA 11 (StataCorp, College Station, TX, USA) processors. Standard deviations are reported in parenthesis following mean values.

Results

A total of 29 patients with upper motor neuron disease and spasticity underwent 32 primary THAs. Two of these patients were lost to follow-up. The remaining 27 patients with 30 THAs were available for final analysis (Table 1). Among these patients etiology of spasticity was cerebral palsy in 12, traumatic brain injury in 9, cerebrovascular accident in 3, multiple sclerosis in 2, and spinal cord injury in 1 patient.

Patients made statistically significant improvements in pain scores, Harris Hip scores, and range of motion following THA (Fig. 1). All patients rated their pain as severe preoperatively (visual analogue pain scale of 8 or greater). At last follow-up, 14 patients reported minimal hip pain (pain score <3), 11 reported mild to moderate hip pain (pain score >2 and <7), and 3 severe hip pain (pain score of 7 or greater). Range of motion, with focus on hip flexion, abduction, and external rotation, all significantly improved following THA. Mean flexion improved from 83.3° to 101°, abduction improved from 14.2° to 36.8°, and external rotation increased from 8.1° to 19.2° ($P < 0.01$). Harris Hip Scores improved from a mean 15.0 (SD = 7.2, range 5–35) to a mean 67.3 (SD = 18.8, range 24–91), which was also statistically significant ($P < 0.01$).