The Journal of Arthroplasty 29 Suppl. 2 (2014) 169–172

Contents lists available at ScienceDirect

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org

Direct Anterior Total Hip Arthroplasty Yields More Rapid Voluntary Cessation of All Walking Aids: A Prospective, Randomized Clinical Trial

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ARTICLE INFO

Article history:
Received 16 August 2013
Accepted 10 March 2014

Keywords:
primary total hip arthroplasty
direct anterior approach
posterior approach
outcomes
complications

ABSTRACT

This study sought to prospectively examine the clinical and radiographic differences between direct anterior (DA-THA) and mini-posterior approach total hip arthroplasty (MPA-THA). Fifty-four patients were prospectively randomized to either MPA or DA-THA. Patient recorded diaries were collected. Radiographs were reviewed. SF-36, WOMAC and HHS scores were tabulated. Time to ambulation without any assistive device favored DA-THA (22 vs. 28 days, $P = 0.04$). Three week SF mental scores favored MPA-THA (60.66 vs. 58.43, $P = 0.01$). In a randomized prospective trial, patients undergoing DA-THA voluntarily quit use of all walking aids on average 6 days earlier than patients with a MPA-THA. Little additional clinical or radiographic benefit was seen between the cohorts.

Standard primary total hip arthroplasty (THA) can reliably alleviate pain, improve function, and improve the quality of life in a broad section of patients with end stage arthrosis of the hip. However, tissue sparing approaches have been devised with the goal of decreasing peri-operative pain, speed early postoperative function, and improve patient satisfaction with the procedure, compared with standard THA. These patient centered goals are combined with the surgeon's desire of a safe, reproducible less invasive procedure that has durable, properly positioned components.

The MPA-THA has been studied extensively, with promising results [1,2]. Others have compared the MPA-THA with other less invasive procedures, and at the current time, it has the most prospective data demonstrating its superiority as a tissue sparing approach [3].

Our purpose will be to determine if differences exist in the attainment of functional milestones that reflect activities of daily living between MPA-THA and DA-THA. The primary endpoint is the difference between groups in the postoperative time that patients require any assistive devices for ambulation. We also hope to determine if the general health outcome after DA THA was better than that after MPA-THA as measured with Short Form-12 (SF-12) scores, and to evaluate variation of surgical factors of the two procedures on the basis of the operative time, component positioning, and occurrence of early complications.

Materials and Methods

This randomized clinical trial was conducted from January 2012 through August 2012. All patients gave written informed consent to participate in the study, and the study was approved by our institutional review board.The inclusion criteria were the following. The patient's age was between 25 to 80 years and elected to undergo primary total hip arthroplasty for primary degenerative arthritis of the hip. Also, the patient was able to comply with the requirements of the study including pre-operative and post-operative evaluations and questionnaires. The exclusion criteria were an age less than 25 or more than 80 years; an inability or unwillingness to comply with the postoperative rehabilitation or follow-up protocols, previous THA, inflammatory arthritis, osteomyelitis or a previous intra-articular infection, severe developmental dysplasia of the hip (such as Crowe type-III or IV dysplasia), known metal allergy, offset greater than 50 mm, acetabular deformity requiring advanced reconstructive techniques, Charcot arthropathy, Paget's disease, or chronic narcotic dependence.

Randomization and Blinding

A stratified randomization was utilized to balance the groups with respect to age (≤65 and ≥65 years of age) and gender (male and female). After patients were enrolled and informed consent was obtained, the randomization was carried out. The patient was blinded with regard to the study group prior to the procedure, but it was not possible or planned for either the patient or the surgeon to be blinded after the procedure. To minimize potential patient bias, each patient was counseled that both techniques are clinically successful

The Conflict of Interest statement associated with this article can be found at http://dx.doi.org/10.1016/j.arth.2014.03.051.

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http://dx.doi.org/10.1016/j.arth.2014.03.051
0883-5403/

procedures. The hypothesis of the study was not discussed with the patients, only that the comparison of the techniques was being made.

Direct Anterior Approach: Surgical Technique

The patient is positioned in a supine position on an orthopedic table. An oblique incision is made over the anterior margin of the tensor muscle at a point approximately 2 cm lateral from the anterior superior iliac spine and extending 10 cm. The interval of the tensor fascia lata and sartorius is developed. A measured resection of the femoral neck is performed. Acetabular reaming is performed and the acetabular component is inserted. The operative extremity is externally rotated, extended and adducted. The femoral implant trial is placed followed by a trial reduction. After appropriate sizing, the final femoral implant and head are placed. Fluoroscopy is utilized to verify the femoral neck cut, acetabular reaming and component positioning, femoral component positioning, leg length, and offset.

Mini-Posterior Approach: Surgical Technique

The patient is positioned in the lateral decubitus position. A 10 cm incision is placed over the greater trochanter, slightly curved posteriorly. An incision is placed just superior to the piriformis tendon through the hip capsule. The hip capsule is retracted posteriorly and is detached with the short external rotators from the posterior aspect of the greater trochanter extending down to and often including the quadratus muscle. Following dislocation and measured neck resection, the acetabulum and femur are prepared. Following implantation of the arthroplasty, the capsular closure includes suture re-approximation of the superior capsule to the posterior aspect of the greater trochanter.

Implant Selection

The same femoral component design (Corail; DePuy, Warsaw, Indiana) and the same acetabular component design (Pinnacle; DePuy) were used in every case.

Perioperative Management

All patients were encouraged to move from bed to a chair on the day of surgery and begin walking with weight-bearing as tolerated on the morning after surgery. Two sessions of supervised physical therapy were planned on each hospital day. The patients were discharged from the hospital when they could move in and out of bed with minimal assistance, walk 100 ft (30.5 m) with a walker or crutches, walk up and down three stairs, and control their pain with oral medication. Both groups had the same standardized muscle rehabilitation protocols. The posterior approach patients had range of motion arch restrictions for flexion limited to 90° and no adduction beyond neutral. The anterior approach patients had no range of motion restrictions. Otherwise, the patients were encouraged to proceed with activities as tolerated, allowing the hip symptoms to be their guide.

Assessment of Early Functional Outcome

The primary early functional endpoint was the number of postoperative days that patients required any assistive devices for ambulation. The secondary early function endpoints were assessed through attainment of other functional milestones, including the time to discontinue a walker or crutches, the time that patients needed assistance for activities of daily living, the time to return to work (if applicable), the time to discontinue narcotic pain medication, the time to ascend and descend stairs, and the time to walk one-half mile (0.8 km).

Secondary clinical endpoints were assessed through patient reported outcomes, as well as clinical data. The following validated questionnaires were used: Harris Hip Score, WOMAC, and SF-12. Patients completed these questionnaires pre-operatively and at 3 weeks, 6 weeks, and 12 months post-operatively. Patients were given a diary to complete and were instructed on how to complete it at the pre-operative visit. Patients recorded the date of functional milestones as they occurred. Patients were asked to bring their diaries to each postoperative visit.

Radiographic Outcomes

Standing AP pelvis and lateral x-rays were taken to determine leg length discrepancy (in cm) and implant position (measured by cup abduction angle and cup anteversion angle). X-rays were taken pre-operatively and at 3 weeks, 6 weeks, and 12 months post-operatively. Two of the investigators (XXX and XXX) acted as blinded x-ray reviewers who read all x-rays and collected the radiographic data.

Statistical Procedures

Descriptive statistics including frequencies and proportions were calculated. A sample size estimate was calculated using nQuery software based on the primary outcome variable of time (days) to discontinue all walking assistive devices. For the purpose of this analysis, days were treated as a continuous variable, unless there was a non-normal distribution. For categorical or nominal data or data not normally distributed, medians and interquartile ranges were reported. Statistical differences for these data were determined using a Wilcoxon rank sum test. Improvements in outcome measures over time were evaluated using a repeated measures analysis of variance. An alpha level of 0.05 was used for all analyses to determine statistical significance.

Results

In the DA-THA group, there were twenty-seven patients (twelve men and fifteen women) with a mean age of 62.05 years, a mean body mass index of 27.7. In the MPA-THA group, there were twenty-seven patients (thirteen men and fourteen women) with a mean age of 66.4 years and a mean body mass index of 29.2. There were no measurable differences in the demographic characteristics between the two groups (age $P = 0.25$; gender $P = .50$). No patient was lost to follow-up. All patients enrolled in the study received the treatment as allocated.

Early Functional Outcome

Patients recovered faster after direct anterior total hip arthroplasty than mini-posterior approach total hip arthroplasty as measured by the primary outcome variable, time to ambulation without any assistive device. Using a Student T-test, the mean time to ambulation with no assistive device for the DA-THA group was 22.8 days (SD 11.5 days) compared to 35.1 days (SD 24.6 days) for the MPA-THA group. It is important to note that relative to the DA-THA group, the MPA-THA group was substantially more variable. Therefore, we also considered the difference in the median values using a Wilcoxon rank sum test. These results of a significantly ($P = 0.047$) faster discontinuation of walking aids in the DA-THA persisted. The median time to ambulating without aid was 22 days (IQR 12 to 13 days) compared to 28 days (IQR 20 to 42 days) for the MPA-THA group. There were no statistically significant differences in any of the other measurements of early functional outcome (Table 1).

Secondary Clinical Endpoints

There was a significant ($P = .051$) difference in the preoperative HHS pain scores. The DA-THA group experienced more pain with a