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Outcomes Following Total Hip Arthroplasty for Hip Dysplasia in Older Adults. Are They Comparable to Those with Osteoarthritis?

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Abstract

Background: Total hip arthroplasty (THA) for the treatment of hip dysplasia, which disproportionately impacts the younger population, has been shown to be an effective intervention to restore functionality and improve quality of life. However, it is unclear whether these outcomes can be just as beneficial in treating hip dysplasia when it presents in older patients. Therefore, we sought to investigate and compare the pre-and postoperative outcomes of THA for hip dysplasia in older adults to those with end-stage osteoarthritis (OA).

Methods: A prospectively collected database from a single institution was queried from September 1st, 2016 to October 31st, 2021 to identify 323 unilateral THA patients age 50 years or older and separated into 2 groups given a primary diagnosis of hip dysplasia ($n = 90$ patients) or osteoarthritis ($n = 233$ patients). Preoperative and minimum 1-year postoperative outcomes were then compared using the Hip Outcome Score (HOS), Hip Disability and Osteoarthritis Outcome Score (HOOS), University of California-Los Angeles (UCLA) activity score, Pain Catastrophizing Score (PCS), and the Depression Anxiety Stress Scale (DASS).

Results: The outcomes between the groups showed no significant differences in their pre-and postoperative HOOS ($P = 0.22$ and $P = 0.63$ respectively), DASS Anxiety ($P = 0.81$ and $P = 0.29$ respectively), and the DASS Stress Score ($P = 0.17$ and $P = 0.28$ respectively). Patients with hip dysplasia reported significantly better preoperative (10.1 vs 12.9, $P < 0.001$) and postoperative (5.7 vs 7.2, $P = 0.01$) DASS Depression Scores but scored significantly lower in the pre-operative HOS (35.4 vs 42.2, $P < 0.05$). Outcomes for the UCLA activity score uncovered that patients with hip dysplasia scored significantly higher preoperatively (4.8 vs 4.2, $P = 0.02$), but no significant difference was seen postoperatively (4.6 vs 5.0, $P = 0.11$). The PCS noted no significant differences preoperatively (23.2 vs 21.0, $P = 0.12$). However, the hip dysplasia group has significantly better postoperative scores (6.6 vs 10.0, $P = 0.02$).

Conclusion: Our investigation demonstrates THA as an excellent surgical option for treating hip dysplasia when presenting in older adults and can yield comparable outcomes as those noted in THA performed for OA in older adults.

Introduction

Hip dysplasia is a progressive pathological condition that causes subluxation of the femoral head, hip dislocation, and acetabular dysplasia commonly affecting the population of adolescents and young adults [1–3]. It arises from untreated or severe presentations of developmental dysplasia of the hip, which is the term used to reference hip dysplasia when it presents during early infancy and childhood [4, 5]. Although comprehensive screening protocols are the standard of practice for early detection, a significant number of cases go undiagnosed until adulthood, which increases the patient's risk of developing an early onset of hip joint complications [6, 7].

Surgical interventions such as resurfacing arthroplasty, femoral or periacetabular osteotomy, and total hip arthroplasty (THA) are common practices to treat severe forms of hip dysplasia [8, 9]. Due to anatomical deformities of the acetabulum and proximal femur typically found in these patients, THA becomes very challenging, even for the most experienced surgeon. Consequently, the rate of revision of THA for hip dysplasia is frequently higher than for any other primary hip diagnosis [10–13]. Current literature reveals that the main cause for THA revisions in younger patients with hip dysplasia is from aseptic loosening, which differs from infections and dislocations as the main causes found in older patients [14, 15]. Nevertheless, THA for the treatment of hip dysplasia has been shown to be an effective intervention to restore functionality and improve the quality of life for this younger patient population. However, recognizing if these surgical outcomes can be just as beneficial for the treatment of hip dysplasia when it presents in older patients is less understood and became the primary focus of our research. Therefore, we sought to investigate and compare the preoperative and postoperative outcomes of THA for hip dysplasia in older adults to those with end-stage osteoarthritis (OA).

Methods

Study Selection

This IRB-approved investigation utilized a prospectively collected database that was queried from a five-year period spanning September 2016 to October 2021 from a single institution. The total number of THA procedures was gathered and uncovered complete data for 786 eligible subjects that were treated by a single surgeon. The inclusion criteria consisted of patients who underwent a THA for a primary diagnosis of either hip dysplasia or OA, patients who were 50 years and older, and patients with completed preoperative and minimum one-year postoperative patient-reported outcome measures (PROMs). Exclusion criteria consisted of patients who had bilateral THA or any other surgical intervention such as trauma-related injuries, systemic diseases, or THA revisions after their initial THA was performed. The severity of end-stage arthrosis in the hip dysplasia group was not determined by Tönnis grade, but rather by the expertise of the treating surgeon.

Measures

We analyzed the PROMs by utilizing the Hip Disability and Osteoarthritis Outcome Score (HOOS), Hip Outcome Score (HOS), University of California-Los Angeles (UCLA) activity score, Pain Catastrophizing Scale (PCS), and the Depression Anxiety Stress Scale (DASS) that were gathered preoperatively and at a minimum one-year postoperatively to gauge the satisfaction of the THA between the two groups.

The HOOS, HOS, and UCLA activity score were used to assess patient functionality and activity levels. The HOOS is a 40-item questionnaire to assess hip disability in patients with and without OA using five subscales: pain, other symptoms, function in activities of daily living (ADL), function in sport and recreation, and hip-related quality of life [16, 17]. It also is a validated and reliable tool to assess patient opinions about their hip disability, with a Cronbach's alpha coefficient between 0.82 and 0.98 [16, 17]. The HOS is a validated and reliable 28-item instrument to evaluate functional ability in arthroscopic hip

surgery patients with two subscales, the ADL subscale and the sports subscale, with a higher score representing a higher level of function [18, 19]. The UCLA activity score is a validated 10-item scale used to quantify physical activity levels in patients with hip and knee joint reconstructions, with a higher score indicating higher activity levels [20, 21].

The PCS and the DASS are two self-reported tools that assess patient psychological metrics. The PCS is a 13-item questionnaire used to gauge three domains of pain catastrophizing, including rumination, magnification, and helplessness [22]. Previous studies have demonstrated that the PCS is a validated and reliable method for the assessment of pain catastrophizing, with scores above 30 considered to be clinically relevant [22, 23]. The DASS-42 is a validated psychometric tool comprised of three self-reported subscales consisting of depression, anxiety, and stress with an additional 14 items per subscale [24, 25].

Statistical Analysis

An independent statistician not involved in any of the patients' interventions performed all data analysis using R package version 1.5.0 [26, 27]. Mean and standard deviations were reported for continuous variables that pertained to the preoperative and postoperative HOOS, HOS, UCLA, PCS, and each DASS subscale score as well as the patients' body mass index (BMI). Univariate analyses were performed to test the difference and mean differences between preoperative and postoperative PROMs using a two-sample t-test. Categorical variables of patient characteristics include their age at the time of surgery and sex, while the operative characteristics include surgical approach, laterality, and number of postoperative hospital days. The two categorical groups were reported using counts and proportions and were analyzed using the exact chi-squared test. P values < 0.05 were considered statistically significant for both continuous and categorical variables.

Results

Of the 786 eligible patients, a total of 323 patients met all criteria and were included in this study. A total number of 90 patients (30 male, 60 female) comprised the hip dysplasia group while 233 patients (104 male, 129 female) comprised the OA group (Figure 1).

The patients with hip dysplasia were significantly younger (mean age, 62.3 vs 69.2 years; $P < 0.001$) and had a significantly lower BMI (mean 27.4 vs 29.8; $P < 0.001$) than the OA group. In regard to baseline Tönnis grades, the hip dysplasia group had a significantly higher rate of patients who were measured with grades 0/1 (18.9% vs 5.6%, $P < 0.001$) than the OA group. In contrast, the OA group had significantly more patients with grades 2/3 (94.4% vs 81.1%, $P < 0.001$) than the hip dysplasia group. Of note, the length of follow-up days between the hip dysplasia group and the OA group (679 vs 523; $P = 0.23$), showed no significant difference (Table 1).

Two surgical approaches (direct anterior vs posterolateral) were used for each case and determined at the surgeon's discretion. The direct anterior approach was used significantly more for the hip dysplasia group (76.7% vs 58.8%; $P < 0.05$), while the posterolateral approach was used significantly more for the

OA group (41.2% vs 23.3%; $P < 0.05$). The hip dysplasia group had significantly more THA procedures of their left hip (51.1% vs 38.2%; $P = 0.04$), while the OA group had significantly more THA procedures of their right hip (61.8% vs 48.9%; $P = 0.04$). There were no significant differences ($P = 0.669$) found between the groups in the length of postoperative hospital days (Table 2).

Comparison of the PROMs uncovered that there was no significant difference between the hip dysplasia group and the OA group for the reported preoperative HOOS (37.4 vs 40.3, $P = 0.22$) and postoperative HOOS (81.7 vs 80.7, $P = 0.63$). The outcomes of the HOS noted significantly lower preoperative scores for the hip dysplasia group (35.4 vs 42.2, $P < 0.05$) and lower postoperative scores (83.4 vs 82.9, $P = 0.72$) than the OA group, but the latter outcome was not significant. Reported outcomes for the UCLA activity score uncovered that patients with hip dysplasia scored significantly higher preoperatively (4.8 vs 4.2, $P = 0.02$). However, no significant difference was seen postoperatively (4.6 vs 5.0, $P = 0.11$) compared to those with OA (Table 3).

Reports of the PCS noted no significant differences preoperatively (23.2 vs 21.0, $P = 0.12$). However, the hip dysplasia group had significantly better postoperative scores (6.6 vs 10.0, $P = 0.02$) than the OA group. The reported DASS outcomes revealed no significant differences in the preoperative and postoperative DASS-Anxiety subscale score (6.7 vs 6.9 and 2.8 vs 3.2 respectively, $P = 0.81$ and $P = 0.29$ respectively) and DASS-Stress subscale score (9.3 vs 8.0 and 5.0 vs 4.4 respectively, $P = 0.17$ and $P = 0.28$ respectively) between the 2 groups. The DASS-Depression subscale uncovered that the hip dysplasia group reported significantly lower scores preoperatively and postoperatively (10.1 vs 12.9 and 5.7 vs 7.2 respectively, $P < 0.001$ and $P = 0.01$ respectively) than the OA group (Table 3).

There were several PROMs that had significantly different pre-and postoperative mean differences between the hip dysplasia and OA groups. These include the HOS score ($P = 0.004$), UCLA activity score ($P < 0.001$), PCS score ($P < 0.001$), and the DASS-Depression subscale score ($P = 0.025$). The HOOS score ($P = 0.099$), DASS-Anxiety subscale score ($P = 0.177$), and DASS-Stress subscale score ($P = 0.172$) varied slightly in the mean differences between pre-and postoperative scores, but these were not significant (Table 4).

Discussion

Total hip arthroplasty is one of the most successful and commonly performed orthopaedic procedure used to treat end-stage arthrosis [28, 29]. Furthermore, PROMs are important values that can help surgeons further understand the significance of preoperative diagnoses and how they can influence the course of the postoperative period. Historically, early outcomes of THA relied on morbidity, mortality, and implant survival but due to improvements in postoperative care, the focus has shifted to now emphasize patient satisfaction, functional efficacy, and pain level [30, 31].

Limited research is available that has compared the preoperative and postoperative PROMs of older patients with hip dysplasia to those with OA. To our knowledge, this study utilized the largest comparative series of older adults with hip dysplasia from a single institution with a minimum 1-year

postoperative PROMs. Boyle et al. reported no significant difference in postoperative functional outcomes between patients with hip dysplasia and OA who underwent THA [32]. However, the patients in the study were gathered using a national database, which can cause the reported outcomes to vary between patients due to contrasting surgical techniques and experiences from surgeons across different regions. Furthermore, only 6-month postoperative PROMs were reported without establishing baseline preoperative outcomes.

Psychological disorders can further add to the complexity of understanding how PROMs may be influenced by patients with hip dysplasia. In an investigation of how these disorders can impact surgical outcomes, Hampton et al., reported that 22% of patients with hip dysplasia reported an abnormal PCS score [33]. Our study uncovered similar results in which 28% of the hip dysplasia group reported a clinically relevant preoperative level of pain catastrophizing. Surprisingly, only 1% of patients in this group reported a clinically relevant postoperative PCS score, demonstrating that THA was effective in pain management for hip dysplasia.

Our study has certain limitations. The total number of patients included in the hip dysplasia group was only 35% of the 255 subjects who were eligible for the study. Since our focus was on patients 50 years and older, over 38% of these patients had to be excluded compared to only 1.5% of patients excluded from the OA group, which greatly reduced the power of our study more than anticipated. Similarly, a large number of patients in both groups were excluded due to uncompleted PROMs which could have significantly altered some of the outcomes of our study. Furthermore, our target follow-up period was set to one year postoperatively, so there may be other unmeasured factors that could have both a physical and psychological impact on these PROMS beyond the first year. However, it has been reported that there is no significant difference between postoperative THA outcomes that have been measured after a 1-year and 2-year period [34, 35].

Conclusion

Advancements in modern medicine, both in prosthetic designs and surgical techniques, have broadened the indications for THA. Despite the sophisticated nature and complexity regarding the management of hip dysplasia in older adults, our investigation demonstrates THA as an excellent surgical option and can yield comparable improvement in patient-reported outcomes to those with end-stage OA.

Abbreviations

THA- Total hip arthroplasty

OA- Osteoarthritis

PROMs- Patient-reported outcomes measures

HOS- Hip Outcome Score

HOOS- Hip Disability and Osteoarthritis Outcome Score

UCLA- University of California-Los Angeles activity score

PCS- Pain Catastrophizing Score

DASS- Depression Anxiety Stress Scale

Declarations

Ethics approval and Consent to participate

This study was approved by the institutional review board of the University of Texas Southwestern Research Committee. An exemption from informed consent was obtained from our responsible Human Research Protection Program Department and Investigational Ethics Review Board. All experiments were performed in accordance with relevant guidelines and regulations.

Consent for publication

Not applicable as no identifying personal information is being published in this manuscript

Availability of data and material

All data used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

C.S.J. conceptualized the study, drafted the manuscript, and was responsible for designing all the tables and figures. V.L., R.A., and I.A. gathered the data obtained from the surveys. Y.X. was the statistician for the study, while A.C., N.F., and J.W. contributed to the study design and manuscript preparation. All authors read and approved the final manuscript.

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Tables

Tables 1 to 4 are available in the Supplementary Files section.

Figures

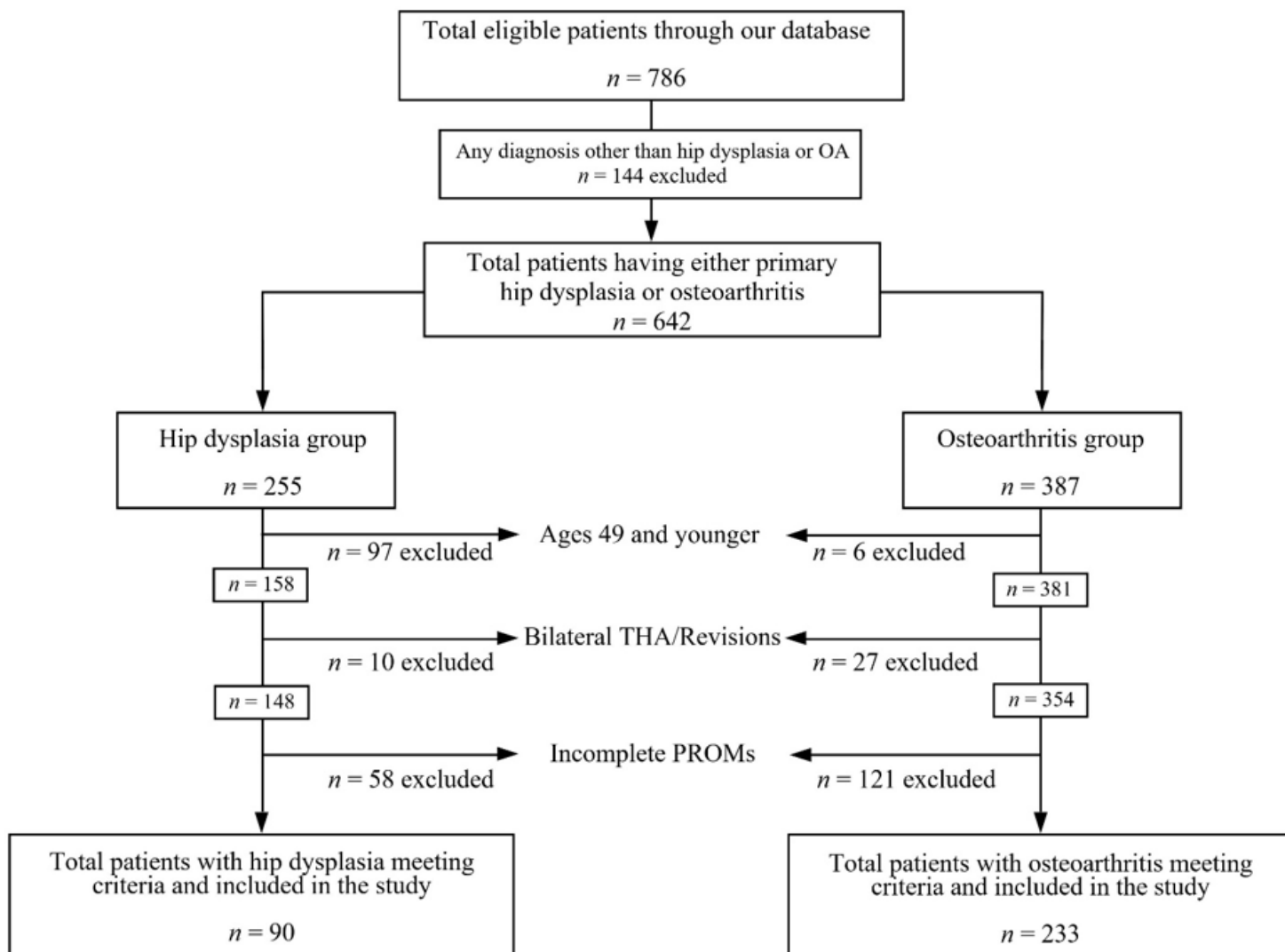


Figure 1

Flow diagram showing study selection

Supplementary Files

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