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National Trends in Primary Total Hip Arthroplasty in Extremely Young Patients: A Focus on Bearing Surface Usage From 2009 to 2012

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ABSTRACT

Background: The ideal bearing surface for primary total hip arthroplasty (THA) in young patients remains a debate. Data on recent national trends are lacking. The purpose of this study is to provide an analysis on the national epidemiologic trends of bearing surface usage in patients aged ≤30 years undergoing THA from 2009 through 2012.

Methods: Using the Healthcare Cost and Utilization Project Nationwide Inpatient Sample from 2009 to 2012, 9265 THA discharges (4210 coded by bearing surface) were identified in patients aged ≤30 years. Prevalence of surface type was analyzed along with patient and hospital demographic data. Statistical analysis was performed using SAS (SAS version 9.1; SAS, Inc, Cary, NC). Significance was set at $P < .05$.

Results: Ceramic-on-polyethylene (CoP) bearing surfaces were most commonly used, representing 35.6% of cases, followed by metal-on-polyethylene (MoP; 28.0%), metal-on-metal (MoM; 19.3%), and ceramic-on-ceramic (CoC; 17.0%) bearing surfaces. Hard-on-hard bearing surfaces (MoM and CoC) represented only 36.4% of cases, a significant decrease from previously reported findings (2006-2009) where hard-on-hard bearing surfaces were the majority (62.2%; $P < .05$). Hard-on-hard bearing surface usage decreased from 2009 to 2012 (MoM: 29.7% to 10.2%; CoC: 20.0% to 14.7%), whereas hard-on-soft bearing surface usage (MoP and CoP) increased. CoP bearing surfaces saw the most significant increase from 25.7% in 2009 to 48.2% in 2012. A cost analysis revealed that CoP discharges were associated with higher hospital charges than other surface types, with an average charge of $66,457 ($P < .05$).

Conclusion: Use of hard-on-hard surfaces has decreased significantly in this population, whereas CoP and MoP surfaces have become increasingly common. Determining the optimal bearing surface for extremely young patients continues to be a challenge for orthopedic surgeons as they weigh the risks and benefits of each.

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Total hip arthroplasty (THA) is the standard surgical treatment for intractable hip pain secondary to degeneration [1-4]. The national incidence of total hip arthroplsties performed is increasing, and this trend is expected to persist [5]. Metal on polyethylene (MoP) has been the primary preferred bearing surface for many years. Concerns for polyethylene wear, particularly in younger patients with increased activity demands, have led to the development of alternative bearing surfaces [6-10]. These alternative bearing surfaces, including metal-on-metal (MoM), ceramic-on-ceramic (CoC), and ceramic-on-polyethylene (CoP) articulations, have their own set of advantages and disadvantages. These unique properties must be considered when determining the ideal articulation for the individual patient.

For extremely young patients requiring THA, choosing the ideal bearing surface is an important challenge in the orthopedic community [11-20]. Although hard-on-hard surfaces (MoM and CoC) have the potential advantage of superior longevity [13,15,16], MoM articulations in particular are associated with metal ion release,

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resulting in both local and systemic metal ion reactions [20-22]. In addition, CoC articulations are associated with increased concerns of fracture necessitating revision [23-25] and acoustic changes that may be disturbing to the patient [26,27]. CoP articulations have shown a decrease in fractures and acoustic changes compared with CoC [28,29].

Despite these developments, it is not clear which bearing surface is currently preferred for extremely young patients undergoing THA [11-20]. Analysis of national epidemiologic trends from 2006 through 2009 demonstrated that hard-on-hard surfaces (MoM, CoC) were used more frequently than traditional MoP bearing surfaces in extremely young patients undergoing THA [15]. This is a follow-up study to present trends in bearing surface usage in patients aged ≤30 years undergoing primary THA from 2009 through 2012. The purpose of this study is to provide a follow up analysis on the national epidemiologic trends of bearing surface usage in patients aged ≤ 30 years undergoing THA from 2009 through 2012. We hypothesize that the rates of hard-on-hard bearing surfaces have decreased because of recently reported complications of these implants in the literature.

Methods

Data for this study were obtained from the Nationwide Inpatient Sample (NIS), which is part of the Healthcare Cost and Utilization Project sponsored by the Agency for Healthcare Research and Quality [30]. The NIS is used to obtain national estimates of health care utilization, access, charges, quality, and outcomes. As of 2012, the database included 44 states, which represents >95% of the United States population. The NIS approximates a 20% stratified sample of discharges from community hospitals in the United States (including public hospitals and academic centers) and excludes rehabilitation and long-term acute care hospitals. In 2012, the data set was redesigned in an attempt to create more accurate national estimates [31]. Of note, identifiable patient information is present in the NIS because state and hospital identifiers are no longer provided. Each patient stay is categorized in the data set as a "discharge." Diagnosis and procedures were selected using International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes. National estimates were calculated through discharge weights provided by the NIS [32].

Study Population

The NIS was accessed from the 2009 through 2012 data collection time period. All patients aged ≤30 years that underwent a primary THA (ICD-9: 8151) were selected for analysis. This patient group was analyzed and subsequently divided into subgroups based on secondary procedure codes for bearing surface type. Four subgroups were identified: (1) MoP (ICD-9: 00.74), (2) MoM (ICD-9: 00.75), (3) CoC (ICD-9: 00.76), and (4) CoP (ICD-9: 00.77). Two categories of bearing surfaces were evaluated: (1) hard-on-hard bearing surfaces (MoM and CoC) and (2) hard-on-soft bearing surfaces (MoP and CoP). The frequency of different bearing surface types used was presented. Patient factors were studied and compared, including age, gender, race, diagnosis, and primary payer. Hospital characteristics were also reviewed, including hospital charges, length of hospital stay, hospital size, and hospital location. Our study design modeled a previous analysis of the years 2006-2009 [15].

Statistical Analysis

Statistical analyses were performed using SAS (SAS version 9.1; SAS, Inc, Cary, NC). Significance of changes over time was assessed using z tests, χ^2 tests, and t tests. Statistical significance was set using a P value of <.05.

Table 1
National Trends in Total Hip Arthroplasty in Patients Aged ≤30 Years From 2009 to 2012.

	2009	2010	2011	2012	Total/Mean
N	2289	2280	2566	2130	9265
Age	24.9	24.4	24.5	24.4	24.5
LOS	3.6	3.4	3.3	3.2	3.4
Charges	58,137	57,678	61,881	63,793	60,361
Females	1117 (48.9)	1150 (50.7)	1277 (50.4)	1040 (48.8)	4584 (49.5)
No. of cases that had coding for bearing surface type (%)	1142 (49.8)	988 (43.3)	1095 (42.6)	985 (46.2)	4210 (45.4)

N indicates total number of discharges; "Age" indicates mean age; "LOS" indicates length of hospital stay; "Charges" indicates mean total hospital charges; "Females" indicates number of females and percentage that were female.

Results

National Trends

National estimates from 2009 through 2012 indicate that there was a total of 9465 discharges for patients aged ≤30 years undergoing a principal procedure of primary THA (Table 1). Over this time period, the annual frequency decreased by 6.9% from 2289 discharges in 2009 to 2130 in 2012 (Fig. 1). Of these discharges, there were 4210 that included bearing surface type in the coding, which represents 45.4% of all patients identified in the study population.

Patient and Hospital Characteristics

The average age for all patients in the study was 24.5 years. There were 4584 females, representing 49.5% of patients in the study.

In 2009 and 2012, patient and hospital characteristics were analyzed in detail and compared (Table 2). Mean age was not different at 24.9 years in 2009 and 24.4 in 2012 ($P = .09$). Average hospital charges increased significantly from $58,137 in 2009 to $63,793 in 2012 ($P < .05$). Length of hospital stay decreased from 3.6

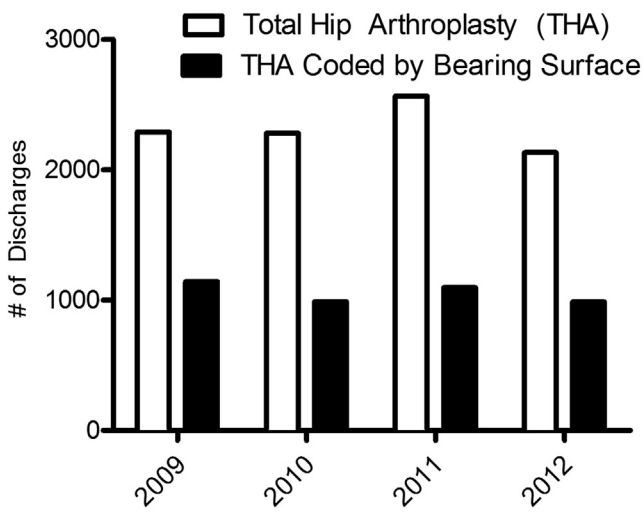

Fig. 1. Bearing surface usage from 2009 to 2012.

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