The Journal of Arthroplasty 30 Suppl. 1 (2015) 121–124

Contents lists available at ScienceDirect

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org

Cartilage Status at Time of Arthroscopy Predicts Failure in Patients With Hip Dysplasia

Maureen K. Dwyer, PhD, ATC [a,b], Jo-Ann Lee, MS [a], Joseph C. McCarthy, MD [a,b]

[a] Kaplan Joint Center, Newton Wellesley Hospital, Newton, Massachusetts
[b] Department of Orthopedics, Massachusetts General Hospital, Boston, Massachusetts

ARTICLE INFO

Article history:
Received 25 September 2014
Accepted 8 December 2014

Keywords:
hip arthroscopy
dysplasia
predictors
hip
cartilage

ABSTRACT

The purpose of our study was to determine whether chondral damage at the time of arthroscopy predicted conversion to THA in patients with dysplasia. We identified 166 patients with dysplasia who underwent hip arthroscopy. Forty-seven went on to receive THA. The articular cartilage of three regions of the acetabulum and femoral head were assessed for signs of chondral damage (absent, mild, or severe]). A stepwise multivariable logistic regression analysis revealed mild damage on the posterior femoral head ($P = 0.001$) and severe damage on the anterior acetabulum ($P = 0.007$) made a significant contribution to the predictor. The presence of mild posterior femoral head chondral changes was indicative of more global cartilage damage in this series of patients. Our findings show that chondral damage on the posterior femoral head and anterior acetabulum is a strong predictor of ultimate conversion to THA in dysplastic patients.

Hip dysplasia is a commonly recognized source of pain and disability and has been associated with accelerated and early joint disease. Dysplasia is characterized by a bony under-coverage of the femoral head, resulting in overloading of the articular cartilage surfaces and increased contact forces on the acetabular rim, particularly the antero-superior region [1–3]. The lack of bony coverage results in a hypertrophied labrum to augment femoral head coverage and improve joint stability [4,5]. As a result, the labrum encounters increased loads, which can lead to injury [2]. A high prevalence of labral lesions has been reported for patients with dysplasia, oftentimes associated with concomitant chondral lesions [3,4,6–8]. Disruption of the labral–chondral complex precipitates the onset of symptoms in dysplastic patients [7].

Traditional treatment for young patients with symptomatic dysplasia has involved redirectional osteotomies; however, the use of arthroscopic procedures to address the resulting labral and chondral damage has become more prevalent in recent years. While arthroscopy has shown some success in these patients, failure rates as high as 64% have been reported [9–11]. Inadequately addressed bony abnormalities were found to be the most common cause of repeat hip preservation surgeries for patients with dysplasia, with the majority undergoing a subsequent periacetabular osteotomy [10,11]. However, for patients in whom joint disease is already present in the hip, major reconstructive procedures may provide the only relief of symptoms. In a single series of patients with dysplasia who had a failed primary arthroscopy, 37% required conversion to a total hip arthroplasty (THA) [10]. It is unknown whether knowledge of the status of the articular cartilage of the hip at the time of arthroscopy would assist with predicting the eventual need for THA in patients with dysplasia. Understanding which factors contribute to ultimate joint failure in dysplasia will help guide treatment strategies and appropriately counsel patients. The purpose of our study was to determine whether the severity of femoral and acetabular chondral damage at the time of arthroscopy predicted eventual conversion to THA in patients with hip dysplasia.

Materials and Methods

Using our institutionally approved prospective database of hip arthroscopy patients, we identified 282 patients (334 hips) with borderline to moderate dysplasia who underwent arthroscopic evaluation of their hip to treat a symptomatic labral tear between 2000 and 2013. Indications for surgery included anterior, inguinal, trochanteric, or buttock pain with or without mechanical symptoms, along with confirmation of intra-articular pathology via MRI or arthrography. Additional indications included patients who had residual pain and symptoms, which did not respond to activity modification, nonsteroidal anti-inflammatories, physical therapy, or time. Candidates for arthroscopy did not exhibit radiographic evidence of degenerative joint changes prior to surgery. The entire cohort consisted of 209 females (74%) and 73 males (26%) with an average age of 34.8 ± 13.8 years at time of arthroscopy. Data on whether a patient had undergone a subsequent THA on their surgical hip were obtained from patient charts and

One or more of the authors of this paper have disclosed potential or pertinent conflicts of interest, which may include receipt of payment, either direct or indirect, institutional support, or association with an entity in the biomedical field which may be perceived to have potential conflict of interest with this work. For full disclosure statements refer to http://dx.doi.org/10.1016/j.arth.2014.12.034.

Reprint requests: Maureen K. Dwyer PhD, ATC, Kaplan Joint Center, Newton Wellesley Hospital, 2000 Washington Street, Green Building, Ste 361, Newton, MA 02462.

http://dx.doi.org/10.1016/j.arth.2014.12.034
0883-5403/

Table 1
Demographic and Surgical Variables for the Study Cohort.

Variable	Category	Follow-Up Cohort	Non-Follow-Up Cohort
Age at arthroscopy		37.1 ± 11.1	35.9 ± 10.6
Gender	Male	36 (22%)	37 (32%)
	Female	130 (78%)	79 (68%)
Labral tear	No	16 (8%)	20 (15%)
	Yes	185 (92%)	113 (85%)
Femoral Outerbridge grade			
Anterior	Normal	145 (72%)	96 (72%)
	Mild	42 (21%)	20 (15%)
	Severe	14 (7%)	17 (13%)
Posterior[a]	Normal	163 (92%)	119 (90%)
	Mild	15 (8.4%)	9 (7%)
	Severe	0	5 (4%)
Superior	Normal	144 (84%)	59 (87%)
	Mild	14 (8%)	3 (4%)
	Severe	13 (8%)	6 (9%)
Acetabular Outerbridge grade			
Anterior	Normal	37 (18%)	35 (26%)
	Mild	90 (45%)	52 (39%)
	Severe	74 (37%)	46 (25%)
Posterior	Normal	150 (75%)	96 (72%)
	Mild	43 (22%)	33 (25%)
	Severe	7 (4%)	4 (3%)
Superior[a]	Normal	116 (60%)	76 (74%)
	Mild	73 (38%)	22 (21%)
	Severe	5 (3%)	5 (5%)

[a] Indicates a statistically significant difference between the follow-up cohort and the non-follow-up cohort (posterior femoral head: $P = 0.03$; superior acetabulum: $P = 0.01$).

subsequent visits with the operating surgeon. If a THA was performed, the date of the procedure was recorded. If not, the date of the most recent contact was used as the follow-up date. Patients who had incomplete records (follow-up date greater than 12 months old) were excluded from the study. Follow-up data were obtained from 166 patients (201 hips). The follow-up cohort consisted of 130 females (78%) and 36 males (22%) with an average age of 37.1 ± 11.1 years at the time of surgery. There were 130 right hips (65%) involved and 71 left hips (35%). The follow-up cohort was similar in age and gender to the non-follow-up cohort (Table 1). Only patients with follow-up data were included in the analyses. Approval was obtained by our institution prior to initiation of this study.

Radiographs were obtained for all patients prior to surgery and were used to determine the presence and severity of dysplasia. Borderline dysplasia was defined as a center-edge angle of Wiberg between 22° and 28° [12] and moderate dysplasia was defined as an angle between 16° and 22° [8,13,14]. In addition, a patient was considered to have dysplasia if the lateral roof angle was 0° or upsloping. All patients underwent arthroscopy in the lateral decubitus position with a dedicated hip distractor set at 7–10 mm of distraction. All arthroscopies were performed as outpatient procedures. At the time of surgery, the morphologic features and location of all labral and articular cartilage lesions were identified and graded for severity by the senior author. Findings from each surgical procedure were recorded using audio and visual media and entered into the database. Labral abnormalities were described by location (posterior, lateral, anterior). The severity of the femoral and acetabular articular cartilage lesions was graded for each region (anterior, superior, posterior) according to the Outerbridge classification system [15], where grade I refers to softening and/or swelling of the cartilage; grade II refers to fragmentation and fissuring extending less than 10 mm in diameter; grade III consists of fragmentation and fissuring extending greater than 10 mm in diameter; and grade IV refers to full-thickness cartilage erosion with exposed subchondral bone. The degree of damage was classified as absent, mild (grades I or II), or severe (grades III or IV) for analysis purposes.

Forty-seven patients went on to receive total hip arthroplasty at an average of 2.7 ± 2.3 years after arthroscopy. To determine the presence of correlations between patient and surgical factors and eventual need for a THA, separate univariate crosstabulations were conducted with THA or no THA as the binary outcome for gender, acetabular and femoral head Outerbridge grades, and presence of labral tear. Patient age at time of arthroscopy was compared between the two groups (THA, no THA) using an independent samples t-test. A stepwise multivariable logistic regression analysis was then conducted to determine predictors of the eventual need for THA following hip arthroscopy for patients with dysplasia. Odds ratios and 95% confidence intervals (95% CI) were calculated for all significant independent predictors. All statistical analyses were performed using IBM SPSS v.21.0 (IBM Corporation, Armonk, NY). The level of statistical significance was set at $P < 0.05$.

Table 2
Prevalence of Articular Cartilage Lesions on the Femoral Head.

	Posterior		Superior		Anterior	
	THA	No-THA	THA	No-THA	THA	No-THA
Normal	76.1%	96.8%	57.1%	91.2%	51.1%	78.6%
Mild	23.9%	3.2%	20.0%	5.1%	29.8%	18.2%
Severe	0.0%	0.0%	22.9%	3.7%	19.1%	3.2%

Results

The 47 patients who underwent THA were older (43.0 ± 8.3 years) than the non-THA patients (n = 119; 35.2 ± 11.3 years; $P < 0.001$) at time of arthroscopy, and there were a lower percentage of females in the THA group (67%) when compared to the non-THA group (82%; $P = 0.039$). Follow-up data for the non-THA patients revealed arthroscopy provided symptom-relief, and, at the time of follow-up, patients did not have recurrence of symptoms, which pre-empted further surgical intervention. Observations at the time of surgery revealed the presence of a labral tear in 186 hips, located anteriorly in 185 hips (117 antero-medially) and postero-laterally in 1 hip. Concomitant lesions to the posterior (6 hips) and lateral (1 hip) labrum were also observed for 7 patients with anterior labral tears. The percentage of patients with a labral tear did not differ between THA patients (95%) and non-THA patients (92%; $P = 0.26$). Chondral lesions were present on the femoral head in a total of 8% of patients posteriorly, 16% of patients superiorly, and 28% of patients anteriorly (Table 2). The percentage of lesions on the femoral head differed between THA and non-THA patients for all regions ($P < 0.001$). For the acetabulum, chondral lesions were present in a total of 25% of patients posteriorly, 40% of patients superiorly, and 82% of patients anteriorly (Table 3). The percentage of lesions on the acetabulum differed between THA and non-THA patients for all regions (posterior and anterior: $P < 0.001$; superior: $P = 0.033$).

Bivariate logistic regression revealed presence of mild chondral changes on the posterior femoral head ($P = 0.002$) and severe chondral changes on the anterior acetabulum ($P = 0.013$), made a significant contribution to the predictor, independent of age, gender, and lesions on the anterior and superior femoral head and superior and posterior acetabulum (Table 4). Patients with mild arthritic changes (grades I and II) of the posterior femoral head were 42.96 times (95% CI: 4.05, 455.64) more likely to convert to THA, while patients with moderate to severe arthritic changes (grades III and IV) of the superior acetabulum were 14.21 times (95% CI: 1.75, 115.58) more likely to convert to THA.

Discussion

Acetabular dysplasia is characterized by a shallow hip socket, which results in insufficient coverage of the femoral head. The lateral uncovering of the femoral head alters the loading characteristics of the joint and often leads to pain, joint instability, and increased contact pressures on the acetabular rim. While pelvic osteotomies have traditionally been the treatment of choice for patients with dysplasia, the use of arthroscopic interventions has garnered increased popularity among surgeons. Although hip arthroscopy has been successful for