Relationship Between Age at Onset of Symptoms and Intraoperative Findings in Hip Arthroscopic Surgery

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Background: Hip arthroscopic surgery is intended to treat multiple abnormalities in an effort to delay the progression to osteoarthritis, especially in young patients. However, the length of time in which patients experience joint pain before seeking a specialist for a diagnosis can delay hip preservation surgery and influence clinical outcomes.

Purpose: To investigate the relationship between age at symptom onset and findings during hip arthroscopic surgery as well as outcomes after 2 years of clinical follow-up.

Study Design: Cohort study; Level of evidence, 3.

Methods: From February 2008 to March 2015, data were prospectively collected on all patients undergoing hip arthroscopic surgery at a single institution. Anatomic and pathological characteristics were recorded intraoperatively. The mean age at onset of symptoms was calculated and correlated with intraoperative findings using Pearson correlation and logistic regression. All patients were assessed preoperatively and postoperatively with 4 patient-reported outcome measures: the modified Harris Hip Score (mHHS), the Non-Arthritic Hip Score (NAHS), the Hip Outcome Score–Activities of Daily Living (HOS-ADL), and the Hip Outcome Score–Sport-Specific Subscale (HOS-SSS). Pain was estimated using a visual analog scale (VAS). Furthermore, patients with an age at onset of symptoms below the mean (34.6 years) were compared with those of an age at onset of symptoms above the mean. The 2 groups were compared using the Student *t* test and the chi-square test. *P* values <.05 were considered significant.

Results: A total of 1697 patients met the inclusion criteria. Body mass index was weakly correlated with age ($r = 0.3$). Younger patients had a lower prevalence of combined Seldes type 1 and 2 labral tears; acetabular labrum articular disruption (ALAD) grade 2, 3, and 4 acetabular chondral lesions; and Outerbridge grade 2, 3, and 4 femoral head chondral lesions ($P < .05$ for all). More advanced age was correlated with wider labral tears and chondral lesions based on a clock face ($r \geq 0.2$, $P < .05$). Patients younger than 34.6 years had a lower prevalence of gluteus medius and ligamentum teres tears ($P \leq .001$). The prevalence of synovitis was positively correlated with age, while instability was negatively correlated with age ($P = .04$). The improvement of scores from preoperatively to 2-year follow-up in the younger patient group was 62.69 to 83.82 for the mHHS, 64.97 to 87.35 for the HOS-ADL, 43.46 to 73.37 for the HOS-SSS, 63.01 to 85.19 for the NAHS, and 5.61 to 2.53 for pain VAS. All score improvements were statistically significant ($P < .001$). Regarding the older patient group, the improvement of scores from preoperatively to 2-year follow-up was 58.55 to 78.27 for the mHHS, 57.59 to 79.66 for the HOS-ADL, 35.63 to 61.88 for the HOS-SSS, 55.28 to 77.55 for the NAHS, and 5.72 to 3.01 for pain VAS. All score improvements were statistically significant ($P < .001$).

Conclusion: Of the multiple intraoperative findings in hip arthroscopic surgery, many are related to age at onset of symptoms. Although we found a statistically significant improvement in clinical outcomes in both groups after 2-year follow-up, apparently the less complex and smaller lesions observed in both the articular cartilage and the labrum of younger patients result in better outcomes compared with older patients.

Keywords: hip arthroscopic surgery; labrum; cartilage; age

The current literature on hip arthroscopic surgery and femoroacetabular impingement (FAI) focuses on diagnosis and treatment in an effort to delay the progression to osteoarthritis, especially in young patients.[1,2,15,20,34] However, the length of time in which patients experience joint pain before seeking a specialist for a diagnosis can delay hip preservation surgery and influence clinical outcomes. Usually, patients affected by FAI present with persistent insidious deep groin, lateral, or buttock pain (C-sign), worsened by prolonged sitting or standing and hip flexion–type

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movements.[37] Often presenting with concomitant labral tears, patients may report mechanical symptoms, such as catching, locking, and clicking.[18] In younger patients, the onset of symptoms is often a consequence of an acute injury or minor trauma, especially in athletes, for whom pain may be exacerbated by excessive demand.[16] On physical examination, decreased range of motion is evident, particularly with passive flexion, internal rotation, and adduction of the affected hip, often referred to as an "impingement test."[5] With pincer-type FAI and posteroinferior impingement, hip extension and external rotation may also elicit pain.[11] The Drehmann sign is positive if there is obligatory passive external rotation of the hip while performing hip flexion.[21] Gluteus medius tears are more common in women and have a peak incidence within the fourth to sixth decades of life.[35] Patients can present with either acute or chronic symptoms. Chronic presentation is more common, with patients typically complaining of the insidious onset of dull pain over the proximal aspect of the lateral hip that may worsen by lying on the affected hip, walking, or climbing stairs.[9,13] There is usually tenderness on palpation of the greater trochanter, limping, or lurch on examination and reduced power on resisted abduction of the hip.[26] In contrast, patients with acute symptoms for traumatic tears can precisely pinpoint the onset of their pain.[36]

On the other hand, an onset of symptoms at older age is related more with the normal degenerative process. Although numerous previous studies have considered the relationship between the patient's age and the outcomes of hip arthroscopic surgery, the possible relationships of age to specific abnormalities of the hip identified during surgery have not been fully evaluated.[12,27,31-33] The purpose of this study was to investigate the relationship between age at onset of symptoms and intraoperative pathological findings during hip arthroscopic surgery with clinical outcomes after 2-year follow-up.

METHODS

From February 2008 to March 2015, data were prospectively collected on all patients undergoing hip arthroscopic surgery at a single institution. Demographic factors, including sex, age at onset of symptoms, height, weight, and body mass index (BMI), were recorded. Anatomic and pathological characteristics, including the type/grade of labral tears, acetabular and femoral head chondral lesions, gluteus medius tears, and ligamentum teres tears, were measured intraoperatively. Patients were included if they underwent hip arthroscopic surgery for any related abnormality and had a minimum 2-year follow-up. Exclusion criteria were revision arthroscopic surgery, Tönnis grade ≥ 2, and previous hip conditions (such as Legg-Calves-Perthes disease, avascular necrosis, and prior surgical intervention). Relationships between age and intraoperative findings were identified both in the overall cohort and in younger and older subgroups. An institutional review board approved this study.

Indications for Surgery

A complete physical examination was conducted on all hips before surgery. Anterior impingement test findings were considered positive if pain was elicited in forced flexion combined with internal rotation of the hip.[5] Lateral impingement test findings were considered positive if symptoms were produced in forced abduction with external rotation. The evaluation of internal snapping of the iliopsoas tendon was performed as the hip was brought from a flexed, abducted, and externally rotated position into extension with internal rotation.[5] Gluteus medius tears were considered positive when there was reduced power on resisted abduction of the hip and tenderness on palpation of the greater trochanter.[10] All physical examinations were performed and documented in degrees by the senior surgeon in a clinical setting.

Surgical Technique

All surgical procedures were performed by the senior author (B.G.D.) with the patient in the modified supine position using a minimum of 2 portals (anterolateral and midanterior).[6,22] After establishing the portals and capsulotomy site, diagnostic arthroscopic surgery of the hip joint was performed.

Intraoperative Data Collection

A detailed intraoperative data sheet was completed for all patients undergoing hip arthroscopic surgery at our institution. At the time of surgery, the width of the labrum (in mm) was measured using a calibrated 5-mm probe at the anterosuperior, anteroinferior, posterosuperior, and posteroinferior positions of the acetabulum. Labral tears were described using the Seldes classification, in which type 1 tears represent separation at the chondrolabral junction and type 2 tears represent intrasubstance damage.[14] The position of the labral tear and acetabular chondral damage were recorded using the clock-face system, in which the notch was defined as 12 o'clock and the midpoint of the transverse ligament was defined as 6 o'clock.[16] Using this system, the acetabulum was divided into 4 quadrants: anterosuperior (from 12 o'clock to 3 o'clock), anteroinferior (from

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Ethical approval for this study was obtained from Advocate Health Care (IRB00001341).

TABLE 1
Demographic Characteristics[a]

	Overall Cohort	Younger Group (Age <34.6 y)	Older Group (Age >34.6 y)	*P* Value Between Groups
No. of patients	1697	825	872	NA
Male sex	616 (36.30)	294 (35.64)	322 (36.93)	.58
Right laterality	910 (53.62)	434 (52.61)	476 (54.59)	.41
Age at onset of symptoms, y	34.6 (8.4-76.2)	22.2 (8.4-34.6)	46.4 (34.6-76.2)	<.0001
Height, inches	67.3 (41-86)	67.5 (57-86)	67.2 (41-84)	.19
Weight, lb[b]	167 (79-357)	159 (79-357)	174.5 (81-350)	<.0001
BMI, kg/cm[2c]	25.8 (13.5-71.1)	24.4 (13.5-49.8)	27.1 (13.9-71.1)	<.0001
Subsequent revision arthroscopic surgery	92 (5.42)	57 (6.91)	35 (4.01)	.009

[a]Data are presented as n (%) for categorical variables and mean (range) for continuous variables. BMI, body mass index; NA, not applicable.
[b]Pearson $r = 0.2$.
[c]Pearson $r = 0.3$.

3 o'clock to 6 o'clock), posterosuperior (from 12 o'clock to 9 o'clock), and posteroinferior (from 9 o'clock to 6 o'clock). The middle of the acetabular lesion was defined as the clock-face position halfway between the most anterior and the most posterior extents of the lesion ; the area of the lesion was measured (in cm^2). Acetabular chondral lesions were described using the acetabular labrum articular disruption (ALAD)[8] and Outerbridge[29] classifications, and their topology was measured using the previously described clock-face system.

Surgical Outcome Measurement

All patients undergoing hip arthroscopic surgery were assessed using 4 patient-reported outcome measures: the modified Harris Hip Score (mHHS), Non-Arthritic Hip Score (NAHS), Hip Outcome Score–Activities of Daily Living (HOS-ADL), and Hip Outcome Score–Sport-Specific Subscale (HOS-SSS). All 4 questionnaires were used because it has been reported that there is no conclusive evidence for the use of a single patient-reported outcome questionnaire for patients undergoing hip arthroscopic surgery.[24,30] Pain was estimated on a visual analog scale (VAS) from 0 to 10 (10 being the worst). Failure was defined as conversion to total hip arthroplasty, the need for revision hip arthroscopic surgery during the study period, or a change in the NAHS value of <10 points.

Statistical Analysis

In the overall cohort, Pearson correlation was used to identify significant correlations between age and continuous measurements such as the size or position of chondral lesions. Similarly, logistic regression was used to identify significant correlations between age at onset of symptoms and categorical measurements such as the grade of chondral lesions or the presence of loose bodies. The overall cohort was also divided into 2 subgroups. The younger and older groups contained patients with an age below and above the mean age of the overall cohort, respectively. The 2 groups were compared using the Student *t* test for continuous measurements and the chi-square test for categorical measurements. *P* values <.05 were considered significant.

RESULTS

From February 2008 to March 2015, there were 1697 patients who met the inclusion criteria. The mean age at onset of symptoms was 34.6 years. The younger group included 825 patients with an age at onset of symptoms less than the overall mean (mean age, 22.2 years), whereas the older group included the remaining 872 patients with an age at onset of symptoms greater than the overall mean (mean age, 46.4 years) (Table 1). Overall, male patients constituted 36.3% of the cohort. Age at onset of symptoms was not related to sex. The mean follow-up was 28.98 months. A significant but weak correlation was found between age and BMI ($r = 0.3$, $P < .0001$). While the mean BMI was 25.8 kg/m^2 overall, it was 24.4 kg/m^2 for patients in the younger group and 27.1 kg/m^2 for patients in the older group.

Significant relationships to age were found in the grade of labral tears and chondral lesions measured intraoperatively. Although the prevalence of labral tears did not significantly differ with age, patients in the younger group had a greater prevalence of Seldes type 1 tears, while patients in the older group had a greater prevalence of Seldes type 1 and 2 tears ($P < .0001$ for both) (Table 2). The younger group demonstrated a higher prevalence of ALAD grades 0 and 1 and a lower prevalence of grades 2, 3, and 4 compared with the older group ($P < .05$ for all). Similarly, patients in the younger group had a higher prevalence of acetabular Outerbridge grades 0 and 1 and a lower prevalence of grades 2 and 4 ($P < .01$). Logistic regression showed significant or near-significant negative correlations between age and the prevalence of ALAD grade 1 or acetabular Outerbridge grade 1 chondral lesions ($P = .06$ and $P = .04$, respectively) as well as a near-significant positive correlation between age at onset of symptoms and the prevalence of ALAD grade 4 chondral lesions ($P = .06$) (Table 2).

TABLE 2
Classification of Labral Tears, Acetabular Chondral Lesions, and Femoral Head Chondral Lesions[a]

	Overall Cohort	*P* Value of Regression[b]	Younger Group	Older Group	*P* Value Between Groups
Labral tear (Seldes)					<.0001
None	17 (1.00)	.48	12 (1.45)	5 (0.57)	.06
Type 1	624 (36.77)	.67	380 (46.06)	244 (27.98)	<.0001
Type 2	481 (28.34)	.99	218 (26.42)	263 (30.16)	.13
Types 1 and 2	545 (32.12)	.85	194 (23.52)	351 (40.25)	<.0001
Acetabular chondral lesion (ALAD)					<.0001
None	227 (13.38)	.50	131 (15.88)	96 (11.01)	.003
Grade 1	532 (31.35)	.06	318 (38.55)	214 (24.54)	<.0001
Grade 2	452 (26.64)	.40	201 (24.36)	251 (28.78)	.04
Grade 3	378 (22.27)	.65	145 (17.58)	233 (26.72)	<.0001
Grade 4	97 (5.72)	.06	25 (3.03)	72 (8.26)	<.0001
Acetabular chondral lesion (Outerbridge)					<.0001
None	157 (9.25)	.12	106 (12.85)	51 (5.85)	<.0001
Grade 1	572 (33.71)	.04[c]	339 (41.09)	233 (26.72)	<.0001
Grade 2	418 (24.63)	.24	182 (22.06)	236 (27.06)	.009
Grade 3	263 (15.50)	.14	116 (14.06)	147 (16.86)	.08
Grade 4	188 (11.08)	.17	44 (5.33)	144 (16.51)	<.0001
Femoral head chondral lesion (Outerbridge)					<.0001
None	1293 (76.19)	.01[d]	699 (84.73)	594 (68.12)	<.0001
Grade 1	24 (1.41)	.79	9 (1.09)	15 (1.72)	.27
Grade 2	82 (4.83)	.20	18 (2.18)	64 (7.34)	<.0001
Grade 3	101 (5.95)	.07	17 (2.06)	84 (9.63)	<.0001
Grade 4	73 (4.30)	.23	21 (2.55)	52 (5.96)	.0005

[a]Data are presented as n (%). ALAD, acetabular labrum articular disruption.
[b]*P* values of logistic regression versus age at onset of symptoms.
[c]Linear coefficient from logistic regression = –0.007.
[d]Linear coefficient from logistic regression = 0.01.

Patients in the younger group had a higher prevalence of no femoral head chondral damage and a lower prevalence of femoral head chondral damage measured as Outerbridge grades 2, 3, and 4 ($P < .05$).

Furthermore, significant relationships to age were found in the size and position of labral tears and chondral lesions measured intraoperatively. Patients in the older group tended to have larger labral tears based on the clock-face system (Table 3). Compared with patients in the older group, patients in the younger group had labral tears that were 0.9 clock-face hours smaller ($P < .0001$), acetabular chondral lesions that were 0.3 clock-face hours smaller ($P < .0001$), and femoral head chondral lesions that were 0.5 clock-face hours larger ($P = .008$) (Table 3). The area of acetabular chondral lesions also tended to be positively correlated with age ($r = 0.2$, $P < .0001$) and was 0.3 cm^2 smaller in patients in the younger group compared with patients in the older group ($P < .0001$). Labral tears and acetabular chondral lesions tended to be centered slightly more posteriorly in younger patients ($r = 0.2$ and $r = 0.09$, respectively; $P < .0001$ for both).

Significant relationships between age at onset of symptoms and several other intraoperative findings were found. Patients in the younger group had a lower prevalence of <25% gluteus medius tears, 25% to 50% tears, greater than 50% tears, and full tears ($P = .2$) (Table 4). Patients in the younger group also had a higher prevalence of no ligamentum teres tears and a lower prevalence of grade 1, 2, and 3 tears based on either the percentile[4] or Gray and Villar[17] classifications ($P \leq .0001$) (Table 4). Patients in the younger group had a lower prevalence of notch osteophytes, synovitis, trochanteric bursitis, and loose bodies ($P < .05$) (Table 4). Logistic regression showed that the prevalence of synovitis was positively correlated with age ($P = .01$) (Table 4). Patients in the younger group had a higher prevalence of subspine impingement, iliopsoas bursitis, and instability; logistic regression showed that the prevalence of instability was negatively correlated with age ($P = –.007$).

The improvement in scores from preoperatively to 2-year follow-up in the younger group was 62.69 to 83.82 for the mHHS, 64.97 to 87.35 for the HOS-ADL, 43.46 to 73.37 for the HOS-SSS, 63.01 to 85.19 for the NAHS, and 5.61 to 2.53 for pain VAS (Table 5 and Figure 1). Regarding the older group, the improvement in scores from preoperatively to 2-year follow-up was 58.55 to 78.27 for the mHHS, 57.59 to 79.66 for the HOS-ADL, 35.63 to 61.88 for the HOS-SSS, 55.28 to 77.55 for the NAHS, and 5.72 to 3.01 for pain VAS (Table 6 and Figure 2). All scores demonstrated a statistically significant improvement ($P \leq .001$) in both groups. Also, when we compared the clinical outcomes after 2-year follow-up between the groups, the results showed that all of the scores were statistically significantly better in the younger group versus the older group ($P \leq .001$) (Table 7 and Figure 3).

TABLE 3
Size and Position of Labra, Labral Tears, Acetabular Chondral Lesions, and Femoral Head Chondral Lesions[a]

	Overall Cohort	*P* Value of Regression[b]	Younger Group	Older Group	*P* Value Between Groups
Labral width, mm					
Anterosuperior	5.0 ± 1.6	.01	4.9 ± 1.5	5.1 ± 1.7	.09
Anteroinferior	4.8 ± 1.2	.3	4.8 ± 1.2	4.8 ± 1.3	.72
Posterosuperior	5.2 ± 1.1	.009	5.2 ± 1.0	5.3 ± 1.1	.05
Posteroinferior	4.3 ± 1.0	.08	4.3 ± 1.0	4.4 ± 1.0	.19
Mean	4.9 ± 1.1	.02	4.8 ± 1.0	4.9 ± 1.1	.12
Labral tear					
Clock-face most posterior	12.1 ± 1.3	<.0001	12.5 ± 1.3	11.8 ± 1.3	<.0001
Clock-face most anterior	14.8 ± 0.9	.006	14.8 ± 0.8	14.9 ± 1.1	.04
Clock-face center	13.5 ± 0.9	<.0001	13.7 ± 0.9	13.3 ± 0.9	<.0001
Clock-face range	2.7 ± 1.3	<.0001	2.3 ± 1.1	3.2 ± 1.3	<.0001
Acetabular chondral lesion					
Clock-face most posterior	12.3 ± 0.9	<.0001	12.5 ± 0.8	12.2 ± 0.9	<.0001
Clock-face most anterior	14.4 ± 0.7	.3	14.4 ± 0.7	14.4 ± 0.8	.21
Clock-face center	13.4 ± 0.7	.001	13.4 ± 0.6	13.3 ± 0.7	.01
Clock-face range	2.1 ± 0.9	<.0001	1.9 ± 0.8	2.2 ± 0.9	<.0001
Size, cm^2	1.1 ± 1.0	<.0001	0.9 ± 0.7	1.2 ± 1.2	<.0001
Femoral head chondral lesion					
Clock-face most posterior	10.6 ± 2.6	.1	10.4 ± 1.1	10.7 ± 2.9	.49
Clock-face most anterior	13.2 ± 1.5	.1	13.6 ± 1.4	13.1 ± 1.5	.04
Clock-face center	11.9 ± 1.2	.7	12.0 ± 1.1	11.8 ± 1.2	.25
Clock-face range	2.8 ± 1.3	.005	3.1 ± 1.2	2.6 ± 1.3	.008

[a]Data are presented as mean ± SD.
[b]*P* values of logistic regression versus age at onset of symptoms.

TABLE 4
Other Intraoperative Findings[a]

	Overall Cohort	Younger Group	Older Group	*P* Value Between Groups
Dysplasia	27 (1.59)	14 (1.70)	13 (1.49)	.73
Excessive femoral anteversion	4 (0.24)	3 (0.36)	1 (0.11)	.58
Heterotopic ossification	3 (0.18)	1 (0.12)	2 (0.23)	>.99
Iliopsoas bursitis	260 (15.32)	155 (18.79)	105 (12.04)	.0001
Iliopsoas impingement/lesion	147 (8.66)	75 (9.09)	72 (8.26)	.54
Instability/microinstability[b]	641 (37.77)	419 (50.79)	222 (25.46)	<.0001
Loose bodies	235 (13.85)	92 (11.15)	143 (16.40)	.002
Notch osteophytes	75 (4.42)	13 (1.58)	62 (7.11)	<.0001
Subspine impingement	38 (2.24)	25 (3.03)	13 (1.49)	.03
Synovitis[c]	210 (12.37)	77 (9.33)	133 (15.25)	.0002
Trochanteric bursitis	216 (12.73)	37 (4.48)	179 (20.53)	<.0001
Gluteus medius tear				.2
None	1376 (81.08)	161 (19.52)	677 (77.64)	
<25%	13 (0.77)	3 (0.36)	10 (1.15)	
25% to 50%	12 (0.71)	0 (0)	12 (1.38)	
>50%	27 (1.59)	1 (0.12)	26 (2.98)	
Full	24 (1.41)	2 (0.24)	22 (2.52)	
Ligamentum teres tear (descriptive classification)				<.0001
No tear	784 (46.2)	504 (61.09)	280 (32.11)	
Low-grade tear (<50% torn)	480 (28.29)	203 (24.61)	277 (31.77)	
High-grade tear (>50% torn)	334 (19.68)	88 (10.67)	246 (28.21)	
Full-thickness tear (100% torn)	76 (4.48)	19 (2.3)	57 (6.54)	
Ligamentum teres tear (Villar classification)				<.0001
None	781 (46.02)	501 (60.73)	280 (32.11)	
Grade 1	57 (3.36)	21 (2.55)	36 (4.13)	
Grade 2	498 (29.35)	234 (28.36)	264 (30.28)	
Grade 3	320 (18.86)	50 (6.06)	270 (30.96)	

[a]Data are presented as n (%).
[b]Linear coefficient from logistic regression = –0.007.
[c]Linear coefficient from logistic regression = 0.01.

TABLE 5
Patient-Reported Outcome Scores for Younger Group[a]

	Preoperative	Postoperative	*P* Value
mHHS	62.69 ± 14.93	83.82 ± 15.46	≤.001
HOS-ADL	64.97 ± 28.20	87.35 ± 43.79	≤.001
HOS-SSS	43.46 ± 25.41	73.37 ± 40.75	≤.001
NAHS	63.01 ± 24.23	85.19 ± 43.81	≤.001
VAS for pain	5.61 ± 2.55	2.53 ± 2.03	≤.001

[a]Data are presented as mean ± SD. HOS-ADL, Hip Outcome Score–Activities of Daily Living; HOS-SSS, Hip Outcome Score–Sport-Specific Subscale; mHHS, modified Harris Hip Score; NAHS, Non-Arthritic Hip Score; VAS, visual analog scale.

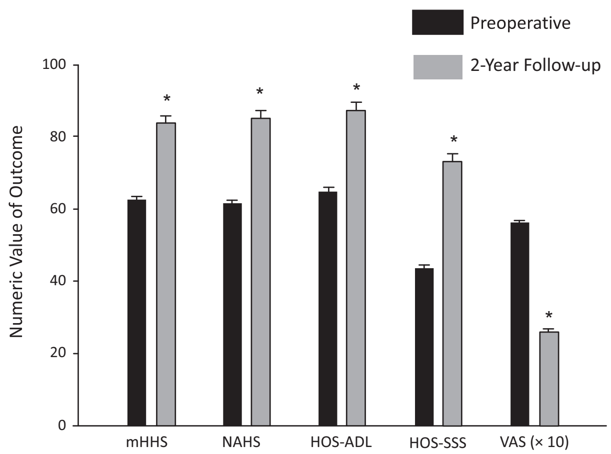

Figure 1. Mean range of patient-reported outcomes in the younger patient group. Error bars represent SDs. *$P \leq .001$. HOS-ADL, Hip Outcome Score–Activities of Daily Living; HOS-SSS, Hip Outcome Score–Sport-Specific Subscale; mHHS, modified Harris Hip Score; NAHS, Non-Arthritic Hip Score; VAS, visual analog scale for pain.

TABLE 6
Patient-Reported Outcome Scores for Older Group[a]

	Preoperative	Postoperative	*P* Value
mHHS	58.55 ± 15.95	78.27 ± 18.10	≤.001
HOS-ADL	57.59 ± 28.12	79.66 ± 40.81	≤.001
HOS-SSS	35.63 ± 24.77	61.88 ± 30.81	≤.001
NAHS	55.28 ± 17.91	77.55 ± 19.36	≤.001
VAS for pain	5.72 ± 2.70	3.01 ± 2.23	≤.001

[a]Data are presented as mean ± SD. HOS-ADL, Hip Outcome Score–Activities of Daily Living; HOS-SSS, Hip Outcome Score–Sport-Specific Subscale; mHHS, modified Harris Hip Score; NAHS, Non-Arthritic Hip Score; VAS, visual analog scale.

DISCUSSION

The results of this study suggest that younger age at onset of symptoms is related to less complex and smaller lesions in both the labrum and the articular cartilage. In addition, older patients tended to have a greater prevalence of gluteus medius injuries, ligamentum teres injuries, notch osteophytes, synovitis, trochanteric bursitis, and loose bodies.

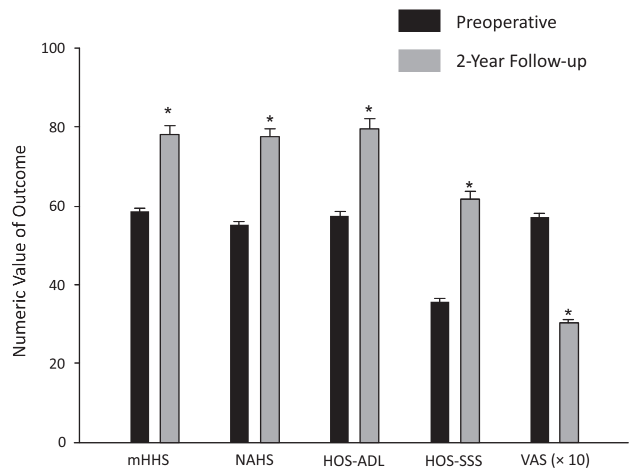

Figure 2. Mean range of patient-reported outcomes in the older patient group. Error bars represent SDs. *$P \leq .001$. HOS-ADL, Hip Outcome Score–Activities of Daily Living; HOS-SSS, Hip Outcome Score–Sport-Specific Subscale; mHHS, modified Harris Hip Score; NAHS, Non-Arthritic Hip Score; VAS, visual analog scale for pain.

Hip arthroscopic surgery is becoming the preferred surgical method for treating many intra- and extra-articular abnormalities around the hip, including labral tears, chondral injuries, FAI, and loose bodies.[6] The treatment of such hip disorders is particularly crucial for hip preservation in young and active patients.[22] Several studies have shown an association between labral tears and the early onset of osteoarthritis.[37] The presence of osteoarthritis negatively affects improvements in pain and function after hip arthroscopic surgery and open preservation hip surgery.[3,38]

As such, the correct selection of patients is an important consideration for preoperative planning. Byrd and Jones[7] showed that younger patients are more likely to benefit from hip arthroscopic surgery, which prolongs the time until total hip replacement is required. In addition, Haviv and O'Donnell[19] found that the interval from primary hip arthroscopic surgery to subsequent total hip arthroplasty was longer in patients younger than 55 years with minimal osteoarthritic changes. Larson et al[23] reported a 52% failure rate in patients who underwent hip arthroscopic surgery in the presence of osteoarthritis.

McCormick et al[28] evaluated the influence of age and arthritis on hip arthroscopic surgery for labral tears. They found that the presence of osteoarthritic changes at the time of arthroscopic surgery was predictive of worse outcome scores compared with the nonarthritic cohort. In addition, age younger than 40 years was predictive of good to excellent results (odds ratio, 7; 95% CI, 2.9-16.9; $P < .0001$). In contrast, Domb et al[14] showed that patients aged ≥50 years may benefit as much as patients aged ≤30 years for arthroscopic treatment. The current study found that older patients did tend to have worse labral and chondral damage, as well as a greater

TABLE 7
Patient-Reported Outcome Scores Comparing Both Groups at 2-Year Follow-up[a]

	Younger Group	Older Group	*P* Value
mHHS	83.82 ± 43.17	78.27 ± 40.56	≤.001
HOS-ADL	87.35 ± 43.79	79.66 ± 40.81	≤.001
HOS-SSS	73.37 ± 40.75	61.88 ± 36.56	≤.001
NAHS	85.19 ± 43.81	77.57 ± 40.53	≤.001
VAS for pain	2.53 ± 2.03	3.01 ± 2.23	≤.001

[a]Data are presented as mean ± SD. HOS-ADL, Hip Outcome Score–Activities of Daily Living; HOS-SSS, Hip Outcome Score–Sport-Specific Subscale; mHHS, modified Harris Hip Score; NAHS, Non-Arthritic Hip Score; VAS, visual analog scale.

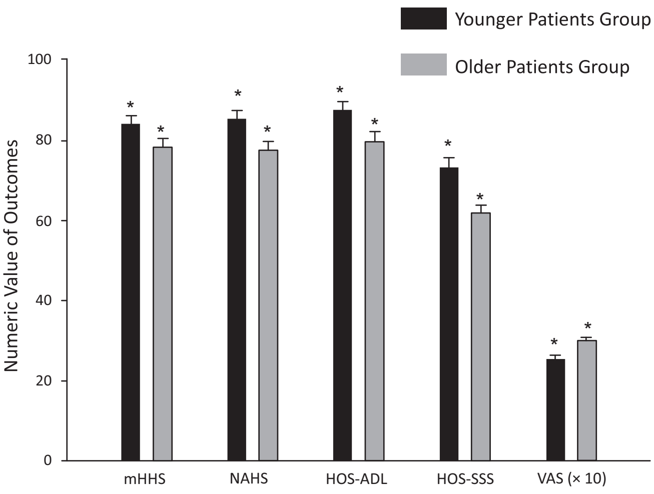

Figure 3. Mean range of patient-reported outcomes compared between both groups. Error bars represent SDs. *$P \leq .001$. HOS-ADL, Hip Outcome Score–Activities of Daily Living; HOS-SSS, Hip Outcome Score–Sport-Specific Subscale; mHHS, modified Harris Hip Score; NAHS, Non-Arthritic Hip Score; VAS, visual analog scale for pain.

frequency of several other pathological findings, at the time of surgery.

The outcomes of hip arthroscopic surgery, in relation to age, depend on the extent of arthritic changes. Philippon et al[33] suggested using joint space width to predict survivorship and recommended not performing hip preservation surgery in patients who have a joint space below 2 mm. At our institution, we do not perform hip arthroscopic surgery in patients with a Tönnis grade ≥2 or in patients with a joint space of less than 2 mm. However, neither joint space nor Tönnis grade assesses cartilage integrity directly; rather, they offer an indirect assessment of the cartilage.

The issue of patient age is further complicated by the time between the onset of symptoms and treatment. The onset of symptoms is often ambiguous, particularly when the development of symptoms is not preceded by a specific traumatic event. MacDonald et al[25] found that in patients who experienced symptoms of osteoarthritis before they were diagnosed, the average time was 7.7 years, and the average age at which people with osteoarthritis had been diagnosed was 50.4 years. In the current study, surgery took place 1.9 years, on average, after the onset of symptoms. Of the overall cohort, 68.9%, 80.1%, and 90.7% of patients underwent surgery less than 2, 3, and 5 years after the onset of symptoms, respectively. Younger and older patients showed no significant differences in the time from the onset of symptoms to surgery.

The effect of patient age on hip arthroscopic surgery is a multifaceted issue that requires further investigation. However, findings have not been entirely consistent, in part because of complicating factors such as the extent of osteoarthritis. The current study sought to provide a context for these previous studies by exploring the differences between younger and older patients in the frequency of various abnormalities that may be identified during surgery. In particular, the large sample size of the current study may make it a valuable resource in contextualizing the results of previous and future investigations.

Limitations

All surgical procedures were performed at a dedicated hip preservation referral center, and the extrapolation of results from one center to another may present challenges. We acknowledge the potential for selection bias but suggest that the large sample size may nevertheless lead toward generalizable trends. Furthermore, we were unable to identify possible confounding factors related to age that may have led to the significant relationships reported in this study. Whether the set of pertinent patient characteristics related with age may be generalized to a population beyond this study cohort is unclear.

CONCLUSION

Of the multiple intraoperative findings in hip arthroscopic surgery, many are related to age at onset of symptoms. Although we found a statistically significant improvement in clinical outcomes in both groups after 2-year follow-up, apparently the less complex and smaller lesions observed in both the articular cartilage and the labrum in younger patients result in better outcomes compared with older patients.

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