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Clinical Presentation of Symptomatic Acetabular Dysplasia in Skeletally Mature Patients

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Background: Acetabular dysplasia is recognized as a cause of early degenerative hip osteoarthritis. The purpose of this study was to prospectively determine the early clinical presentation of symptomatic acetabular dysplasia in skeletally mature patients.

Methods: Fifty-seven consecutive skeletally mature patients with a total of sixty-five symptomatic hips were diagnosed with symptomatic acetabular dysplasia on the basis of the history, physical examination, and radiographs. These fifty-seven patients were enrolled in this study and were followed prospectively for a minimum of twenty-four months postoperatively.

Results: The study group included forty-one female patients (72%) and sixteen male patients (28%) with a mean age of twenty-four years. All were treated with a periacetabular osteotomy and were followed for a minimum of twenty-four months. The initial presentation was insidious in 97% of the hips, and the majority (77%) of the hips were associated with moderate-to-severe pain on a daily basis. Pain was most commonly localized to the groin (72%) and/or the lateral aspect of the hip (66%). Activity-related hip pain was common (88%), and activity restriction frequently diminished hip pain (in 75% of the cases). On examination, thirty-one hips (48%) were associated with a limp; twenty-five (38%), with a positive Trendelenburg sign; and sixty-three (97%), with a positive impingement sign. The mean time from the onset of symptoms to the diagnosis of hip dysplasia was 61.5 months. The mean number of health-care providers seen prior to the definitive diagnosis was 3.3. The mean Harris hip score improved from 66.4 points preoperatively to 91.7 points at a mean of 29.2 months after the periacetabular osteotomy.

Conclusions: The diagnosis of symptomatic acetabular dysplasia is commonly delayed, and procedures other than a pelvic reconstructive osteotomy are frequently recommended. The diagnosis of developmental dysplasia of the hip should be suspected and investigated when a skeletally mature, young, active patient has a predominant complaint of insidious activity-related groin pain and/or lateral hip pain.

Level of Evidence: Prognostic Level IV. See Instructions to Authors for a complete description of levels of evidence.

Acetabular dysplasia is a common deformity that results in an increase in joint reactive forces, acetabular rim overload, and eventually articular cartilage degeneration¹⁻⁷. Many patients with symptomatic and functionally limiting hip dysplasia experience symptoms prior to the development of advanced secondary osteoarthritis. In these patients, acetabular re-orientation can optimize femoral head coverage, decrease articular cartilage loading, delay or prevent the development of secondary osteoarthritis, and enhance patient function and activity⁸⁻¹⁶. To optimize the clinical results of hip joint preservation procedures, the hip should be treated in the prearthritic or early arthritic phase of the disease^{17,18}; thus, early diagnosis is important.

For health-care providers to make a timely diagnosis of symptomatic acetabular dysplasia, they must have a familiarity with the clinical presentation, common findings on physical examination, and radiographic abnormalities. There is a paucity of detailed information regarding the specific signs and symptoms of early symptomatic hip dysplasia. The purpose of this study was to prospectively determine the early clinical presentation of symptomatic acetabular dysplasia in skeletally mature patients. Symptoms, clinical signs, timeliness of diagnosis, and treatment recommendations were analyzed in patients with symptomatic acetabular dysplasia treated with a periacetabular osteotomy.

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Materials and Methods

All participants provided informed consent prior to participation in this study, which was approved by our institutional review board. Patients were recruited from the clinic of the senior authors (J.C.C. and P.L.S.). Fifty-seven consecutive skeletally mature patients with a total of sixty-five symptomatic hips were diagnosed with symptomatic acetabular dysplasia on the basis of the history, physical examination, and radiographs. These fifty-seven patients were enrolled in this study and were followed prospectively for a minimum of twenty-four months postoperatively. Preoperative data were available for all patients, and only one patient was lost to follow-up less than two years postoperatively. The mean patient age was twenty-four years (range, 13.4 to 44.3 years). Forty-one patients (72%), with forty-seven involved hips, were female, and sixteen (28%), with eighteen involved hips, were male. All hips were treated with a periacetabular osteotomy⁸⁻¹⁰. Eight patients had a staged bilateral procedure. Only symptomatic patients whose physical examination and radiographic findings were consistent with acetabular dysplasia and who had had prior unsuccessful nonoperative treatment were included in this study.

Clinical Evaluation

All fifty-seven patients completed a comprehensive set of questionnaires to detail their history and describe their symptom complex. This study design was similar to that of two previous reports from our group^{19,20}. Demographic data, including sex, height, weight, and age at the time of surgery, were recorded for each patient. Patients were asked to characterize their pain with regard to its severity, location, character, duration, mechanical symptoms, aggravating factors, and modes of relief. They were asked about their activity level, which they self-reported as sedentary, active, recreational athletics, or high-level athletics. The onset of symptoms (traumatic, acute, or insidious) was also assessed. The impact of the symptoms on daily activities was solicited through questions regarding limping; the use of assistive devices; and the ability to walk various distances, to ascend and descend stairs, to don shoes and socks, to sit for extended periods of time, and to utilize public transportation²¹. The patients were asked to report prior diagnoses as well as the number and type of health-care providers (physicians, chiropractors, physical therapists, and nurse practitioners) whom they had seen for their hip problem. The length of time from the onset of symptoms to the definitive diagnosis of acetabular dysplasia was also recorded.

The physical examination findings recorded for this study included the presence or absence of a limp and Trendelenburg sign and the results of a hip impingement test²². The hip impingement test was considered positive when passive hip flexion (90°), adduction (10°), and internal rotation (10° to 15°) reproduced the patient's symptom of groin and/or lateral hip pain²². The Harris hip score was administered preoperatively and at each follow-up visit to assess hip pain and function²³. Patients were evaluated at follow-up visits at six weeks, three months, twelve months, and annually thereafter. The clinical response to surgery as measured with the Harris hip score was utilized to confirm that the symptoms at the time of presentation were reduced by surgical correction.

Radiographic Evaluation

The patients were evaluated with supine anteroposterior pelvic, cross-table lateral, false-profile²⁴, and functional flexion-abduction radiographs²⁵. Preoperative degenerative changes in the hip were classified into four grades, according to the criteria outlined by Tönnis and Heinecke²⁶. The radiographic measurements used to evaluate the hip included the acetabular inclination^{3,24,26-28}, the lateral center-edge angle of Wiberg²⁸, the anterior center-edge angle of Lequesne and de Sèze²⁴ as measured on a false-profile radiograph^{3,26,27}, and the hip-joint-center position^{29,30}. Radiographic findings associated with anterior femoroacetabular impingement were also evaluated. The anteroposterior pelvic radiograph was used to determine acetabular version^{26,31-35}. The cross-table lateral radiograph was used to determine femoral head-neck offset according to the method described by Eijer et al.³⁶.

Preoperatively, no patient had radiographic evidence of moderate degenerative joint disease (Tönnis grade 2 or higher) and all had adequate

hip joint congruency as assessed with a functional anteroposterior flexion-abduction radiograph. Radiographically, acetabular dysplasia was defined as a lateral center-edge angle of Wiberg of <25°, an anterior center-edge angle of Lequesne and de Sèze of <20°, and an acetabular roof obliquity of >10°³.

Statistical Evaluation

Chi-square analysis was used to test the proportionality of symptoms. Random probability determines that each category for a symptom would contain roughly the same number of patients. The significance level was set at $p \leq 0.05$. Comparisons of preoperative and postoperative Harris hip scores were done with the Wilcoxon signed-rank test. A paired t test was used to compare the preoperative and postoperative radiographic parameters of the acetabular position, with significance set at $p < 0.05$.

Results

Clinical Results

The preoperative presenting symptoms are presented in Table I. The onset of symptoms was insidious in sixty-three (97%) of the sixty-five hips, acute in one hip, and secondary to a traumatic episode in one hip. The severity of the symptoms was rated by the patient as moderate for thirty-three hips (51%, $p < 0.001$) and severe for seventeen hips (26%, $p < 0.001$). Pain was localized to the groin in forty-seven cases (72%) and to the lateral aspect of the hip in forty-three (66%). Pain was less commonly noted in the anterior aspect of the thigh (29%) or the buttock (18%). No patient had isolated buttock pain, and the presence of buttock pain was always associated with groin pain. Pain in more than one anatomic site was reported in forty-one cases (63%). The quality of the pain was characterized as sharp in forty-nine hips (77%) and as dull in fifty hips (78%). Activity-related pain was noted in fifty-six hips (88%, $p < 0.001$), and night pain was noted in thirty-eight (59%, $p = 0.12$). Increased symptoms were associated with walking in fifty-two cases (81%, $p < 0.001$), running in fifty-one (80%, $p < 0.001$), standing in forty-five (70%, $p < 0.001$), impact activities in thirty-five (55%, $p = 0.61$), pivoting on the affected side in twenty-nine (45%, $p = 0.44$), and prolonged sitting in twenty-eight (44%, $p = 0.20$). At least one mechanical symptom (catching, clicking, popping, or locking) was reported in fifty-one hips (80%). Functional limitations are presented in Table II. Limping was the most commonly reported functional loss and was noted by the patient in association with 48% of the hips. A limited walking distance was associated with 35% of the hips. On physical examination, thirty-one hips (85%) were associated with a limp when the patient was walking a short distance. Twenty-five hips (38%) were associated with a positive Trendelenburg sign and sixty-three (97%) with a positive impingement test.

It was not uncommon for the patients to experience delays in diagnosis, inaccurate diagnoses, and ineffective treatments. The mean time from the onset of symptoms until the definitive diagnosis of acetabular dysplasia was 61.5 months (range, five months to twenty-nine years). The mean delay in diagnosis after the patient initially sought medical care was 41.6 months (range, zero to 204 months). Other providers seen for the condition included primary care physicians (fifty-four), orthopaedic surgeons (109), chiropractors (fourteen), and others

TABLE I Summary of Symptoms Associated with Developmental Dysplasia of the Hip in Present Series

Symptoms	No. of Hips Affected	% of Hips Affected	P Value
Onset of symptoms (n = 65)			
Insidious	63	96.9	<0.001
Acute	1	1.5	<0.001
Traumatic	1	1.5	<0.001
Severity of symptoms (n = 65)			
None	0	0	<0.001
Slight	6	9.2	<0.001
Mild	9	13.8	<0.001
Moderate	33	50.8	<0.001
Severe	17	26.2	<0.001
Location of pain (n = 65)			
Groin	47	72.3	<0.001
Anterior aspect of thigh	19	29.2	<0.05
Lateral aspect of hip	43	66.2	<0.05
Posterior (buttock)	12	18.5	<0.001
Quality of pain (n = 64)			
Sharp	49	76.6	<0.001
Dull (aching)	50	78.1	<0.001
Constant	27	42.2	0.19
Intermittent	34	53.1	0.44
Activity related	56	87.5	<0.001
Night pain	38	59.4	0.12
Mechanical symptoms (n = 64)			
Snapping/popping	43	67.2	<0.001
Locking	15	23.4	0.07
Subluxation	14	21.9	<0.05
None	14	21.9	
Aggravation (n = 64)			
Walking	52	81.3	<0.001
Running	51	79.7	<0.001
Standing	45	70.3	<0.001
Impact	35	54.7	0.61
Pivoting	29	45.3	0.44
Sitting	28	43.8	0.20
Standing from sitting (n = 43)	20	31.3	0.65
Relief mode (n = 64)			
Rest	48	75	<0.001
NSAIDs	36	56.3	0.15
Narcotics	5	7.8	<0.001
Positioning	27	42.2	0.52
Other	7	10.9	

(five). The patients were evaluated by an average of 3.3 health-care providers (range, zero to eleven) prior to the establishment of the definitive diagnosis. Most commonly, patients were diagnosed with some type of soft-tissue injury (eleven hips, 17%)

or osteoarthritis (seven hips, 11%), although radiographs did not demonstrate notable degenerative changes in any hips. A variety of other diagnoses were given for fourteen hips. The most common treatment option recommended by other health-care providers was nonsteroidal anti-inflammatory drugs (NSAIDs) (thirty-seven hips, 57%; $p < 0.15$), and narcotics were recommended to five patients (8%, $p < 0.001$). Physical therapy was recommended for twenty-eight hips (43%, $p = 0.05$). Twelve patients (twelve hips) had previous surgical treatment.

The mean Harris hip scores improved from 66.4 points (range, 44 to 100 points) preoperatively to 91.7 points (range, 39 to 100 points; $p < 0.001$) at the time of the most recent follow-up (at a mean of 29.2 months). One patient (one hip) was lost to follow-up. One patient (one hip) required revision to a total hip arthroplasty, and one required revision surgery because of symptomatic femoroacetabular impingement. Of the remaining sixty-two hips, fifty-nine (95%) had improvement in function and/or diminished symptoms compared with preoperatively ($p <$

TABLE II Functional Limitations Associated with Acetabular Dysplasia in Present Series

	No. of Hips Affected	% of Hips Affected
Limp (n = 65)		
None	10	15.4
Slight	35	53.8
Moderate	16	24.6
Severe	4	6.2
Support (n = 65)		
None	63	96.9
Cane (long distances)	1	1.5
Walker or 2 crutches	1	1.5
Distance (n = 65)		
Unlimited	42	64.6
6 blocks	7	10.8
2-3 blocks	12	18.5
Able indoors only	4	6.2
Stairs (n = 65)		
Normal	30	46.2
With banister	29	44.6
Any method	6	9.2
Public transportation (n = 65)		
Yes	58	89.2
No	7	10.8
Donning shoes (n = 65)		
Easy	49	75.4
Difficult	13	20.0
Unable	3	4.6
Sitting (n = 65)		
60 minutes/any chair	53	81.5
30 minutes/high chair	12	18.5

TABLE III Radiographic Measurements Before and After Periacetabular Osteotomy

Measurements	Mean (Range)			P Value
	Preop.	Postop.	Change	
Lateral center-edge angle (<i>deg</i>)	-1.2 (-30 to 19)	27.4 (10 to 47)	28.7 (5 to 54.0)	<0.0001
Anterior center-edge angle (<i>deg</i>)	-1.65 (-37 to 29)	30.6 (0 to 59)	32.3 (-2 to 71)	<0.0001
Acetabular inclination (<i>deg</i>)	26.2 (12 to 41)	8.02 (-12 to 22)	-18.2 (-39 to 7)	<0.0001
Hip joint medialization (<i>mm</i>)	16.6 (5 to 33)	10.4 (0 to 27)	-6.3 (-23 to 7)	<0.0001

0.001). One patient reported no change postoperatively, and one patient was lost to follow-up.

Radiographic Results

Radiographic analysis demonstrated consistent deformity correction with substantial improvement in femoral head coverage and acetabular inclination postoperatively (Table III). The hip joint center was medialized by a mean of 6.3 mm. The Tönnis osteoarthritis grade was unchanged in fifty-nine hips and had increased by one grade in five. Only one hip had Tönnis grade-2 degenerative changes and no hip had advanced degenerative changes at the time of the most recent follow-up. There were no nonunions of the major acetabular osteotomy cuts (ischial, iliac, or posterior column). One patient developed an asymptomatic nonunion of the osteotomy cut in the superior pubic ramus but did not require additional surgical intervention.

Discussion

The clinical presentation of symptomatic acetabular dysplasia is variable in adults. Definitive diagnosis of this condition is commonly delayed as the specific clinical symptoms and physical findings may be subtle. Radiographic analysis can also be challenging, especially in patients with borderline or mild acetabular deformity. We performed the present prospective study to describe the clinical syndrome associated with symptomatic acetabular dysplasia.

In 1991, Klaue et al. described the acetabular rim syndrome in the dysplastic hip³⁷. Their study demonstrated that the dysplastic acetabulum is associated with abnormal stresses along the rim, which lead to rupture of the limbus, pain, and impaired function. While Klaue et al. discussed the overloading of the soft-tissue structures as the final common pathway in the generation of pain in the dysplastic hip, they did not fully describe the symptom complex associated with acetabular dysplasia. The results of our study enabled us to provide a description of the presenting symptoms, physical examination findings, and radiographic findings associated with acetabular dysplasia as well as the improved clinical function following surgical treatment. The onset of hip pain was primarily insidious (in 97% of the cases) and most commonly involved the groin and/or lateral aspect of the hip. We documented that fifty (77%) of the hips were associated with moderate or severe pain on a daily basis. The disproportionately high number of patients who walked with a limp (85% of the hips) emphasizes the

magnitude of the functional impairment that these patients experienced. Additionally, the mean delay in establishing the correct diagnosis and the finding that patients had been evaluated by multiple health-care providers before obtaining the correct diagnosis indicate the need for improved medical recognition of this disorder.

This study has a number of limitations. First, the data were based on the patients' recollection of the onset of symptoms and time-courses and are thus subjective. It is conceivable that patients with long-standing disease may not accurately recall the duration or cause of their symptoms. Second, there was no age-matched control set of data from patients with hip pain who did not have acetabular dysplasia. Therefore, it is difficult to describe one symptom as being pathognomonic for this syndrome. Third, we cannot exclude the possibility that these same symptoms and signs represented coexisting extra-articular conditions such as hip flexor tendinitis, bursitis, capsular injury, or muscular abnormality. However, the significant improvement in hip scores and the 95% rate of subjective patient-reported improvement (fifty-nine of sixty-two hips) after periacetabular osteotomy strongly support the assumption that the preoperative clinical symptoms were directly related to acetabular dysplasia.

There remains a need for improved awareness of hip dysplasia by clinicians, especially in the setting of radiographically mild disease or subtle clinical symptoms. Skeletally mature patients with acetabular dysplasia remain at risk for a delayed diagnosis and a lack of timely intervention. In young patients, complaints of insidious-onset, activity-related groin pain and/or lateral hip pain should be carefully investigated so that an accurate diagnosis is obtained and the patients can be counseled regarding disease prognosis and treatment options. ■

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