Return to Basketball After Hip Arthroscopy: Minimum 2-Year Follow-up

Austin W. Chen, M.D., Matthew J. Craig, M.D., Brian H. Mu, B.S., Cammille C. Go, B.S., Victor Ortiz-Declet, M.D., David R. Maldonado, M.D., and Benjamin G. Domb, M.D.

Purpose: To present minimum 2-year patient-reported outcomes (PROs) and return to sport (RTS) data for a population of basketball players after hip arthroscopy. **Methods:** Data were prospectively collected and retrospectively reviewed for all patients who underwent hip arthroscopy between February 2009 and May 2014. Patients with preoperative and minimum 2-year postoperative PROs, visual analog scale score for pain, and satisfaction, who regularly played basketball within 1 year before surgery, and who attempted to RTS met the inclusion criteria. Exclusion criteria were previous ipsilateral hip surgery or conditions such as fracture, dysplasia, or femoral avascular necrosis. Patients were matched 1:1 to a control group composed of those who did not play any sports before surgery, based on the following matching criteria: age ±5 years, sex, and body mass index ±5. Statistical analysis was performed to determine significant differences in PROs. Conversion to total hip arthroplasty (THA) was considered an endpoint. **Results:** Thirty-one patients (81.6%) met inclusion criteria with follow-up of 46.8 ± 20.6 months. The mean age was 30.0 ± 12.3, and the mean body mass index was 26.3 ± 6.5. Male patients (64.5%) outnumbered female patients (35.5%). A majority of the players (54.8%) identified themselves as recreational athletes; the remainder competed at the high school, collegiate, amateur, or professional level. There was significant ($P < .001$) improvement in all PRO measures and visual-analog scale scores from baseline to a minimum 2-year follow-up. At the most recent follow-up, mean patient satisfaction was 8.1 ± 2.1. Twenty-two (78.6%), and 23 patients (82.1%) achieved the patient acceptable symptom state on the modified Harris Hip Score and the Hip Outcomes Score—Sports Specific Subscale. Twenty-one (75.0%) and 17 (60.7%) patients had a minimal clinically important difference on the modified Harris Hip Score and the Hip Outcomes Score—Sports Specific Subscale, respectively. Three patients (9.7%) with an average age of 47.5 ($P = .023$) converted to THA at a mean of 35.9 ± 7.2 (range 29.66-43.75) months after arthroscopy. At the most recent follow-up, the RTS rate was 83.9%. Subjective ability level was the same or higher in 23 patients (74.2%). **Conclusion:** Hip arthroscopy in basketball athletes demonstrates a significant increase in PROs, a high RTS rate, and a low risk of complications. Hip arthroscopy may be considered in basketball players <40 years old for whom nonoperative treatment fails and who have a significantly limited level of play. Careful patient selection and counseling should be used when considering hip arthroscopy in basketball players >40 years old because there may be a high rate of conversion to THA. **Level of Evidence:** Level III, retrospective comparative study.

See commentary on page 2845

Introduction

One important cause of intra-articular hip pain in the athletic population, specifically basketball players, is the femoroacetabular impingement (FAI) syndrome.[1] Basketball requires deep hip flexion, abduction, and rotation in addition to rapid and frequent cutting, pivoting, and jumping. These positions and motions increase the forces across the hip joint and often are associated with FAI symptoms.[2-5] This may be because high-level impact sports, such as basketball, place athletes at a 4-fold risk for developing a cam deformity compared with nonathletes.[6] There

From the BoulderCentre for Orthopedics (A.W.C.), Boulder, Colorado; Department of Orthopedics, University of Illinois at Chicago (M.J.C.), Chicago, Illinois; American Hip Institute (B.H.M., C.C.G., D.R.M., B.G.D.), Des Plaines, Illinois; Rosalind Franklin University of Medicine and Science (B.H.M.), North Chicago, Illinois; and Kayal Orthopedics (V.O-D.), Glen Rock, New Jersey, U.S.A.

The authors report that they have no conflicts of interest in the authorship and publication of this article. Full ICMJE author disclosure forms are available for this article online, as supplementary material.

Received August 18, 2017; accepted April 16, 2019.

Address correspondence to Benjamin G. Domb, M.D., American Hip Institute, 999 E. Touhy Ave., Suite 450, Des Plaines, IL 60018, U.S.A. E-mail: DrDomb@americanhipinstitute.org

0749-8063/17887/$36.00
https://doi.org/10.1016/j.arthro.2019.04.029

also is an increasing body of literature that FAI and decreased hip internal rotation increases stresses placed on the anterior cruciate ligament and its risk of injury.[7-10] In addition, younger players have shown epiphyseal extension into the anterosuperior femoral head quadrant, which correlates with an α angle of >55°. Although anatomic changes may not always equate with clinical symptoms, FAI should always be considered when evaluating the basketball player presenting with hip pain.

Multiple studies have shown improvements in patient-related outcomes (PROs) and high rates of return to sport (RTS) at short-term follow-up, with most researchers showing an RTS of ≥80% in all athletes and ≥90% in professionals.[2,11-15] In a survey of high-volume arthroscopic hip surgeons, basketball was considered high risk for failing to RTS.[16]

The purpose of this study was to present minimum 2-year PROs and RTS data for a population of basketball players after hip arthroscopy. We hypothesize hip arthroscopy in basketball athletes results in a high rate (>80%) of RTS and statistically significant and clinically relevant improvements.

Methods

Demographic and intraoperative data were prospectively collected for all patients who underwent arthroscopic hip preservation surgery performed by the senior author (B.G.D.) during the study period of February 2009 to May 2014. Patients were considered for inclusion in this study if they underwent hip arthroscopy with preoperatively recorded PROs, regularly played basketball within 1 year before surgery, and were attempting to RTS. Exclusion criteria were previous ipsilateral hip surgery or conditions such as fracture, dysplasia, or femoral avascular necrosis. Dysplasia is defined at a lateral center edge angle (LCEA) or anterior center edge angle (ACEA) of ≤18°. At our institution, hip arthroscopy is not performed on any patients with arthritic changes greater than Tönnis 1, so it was not necessary to include arthritis as a specific exclusion criterion.

Results for the modified Harris Hip Score (mHHS), Non-Arthritic Hip Score (NAHS), Hip Outcomes Score—Sports Specific Subscale (HOS-SSS), pain on the visual analog scale (VAS), and patient satisfaction on a 0-10 scale were collected preoperatively and at a minimum of 2 years after surgery. International Hip Outcome Tool (iHOT-12) results were also collected at the most recent follow-up. Additionally, the percentage of patients who reached the patient acceptable symptom state (PASS) of ≥74 and ≥75 for mHHS and HOS-SSS, respectively, and a minimal clinically important difference (MCID) of a change of ≥8 and ≥6 for mHHS and HOS-SSS, respectively, were calculated. Any postoperative complications or future ipsilateral hip reoperations were noted. Patients were asked whether they had returned to playing basketball and to subjectively rate their ability level as higher, same, or lower compared with 1 year before surgery, regardless of current participation. These outcomes data were collected at follow-up appointments in clinic or by questionnaires delivered via email or telephone. All patients participated in the American Hip Institute Hip Preservation Registry. Although the present study represents a unique analysis, data on some patients in this study may have been reported in other studies. All data collection received institutional review board approval.

Indications for Surgery

A detailed patient history, physical examination, and radiographic analysis were conducted for all surgical candidates. Gait, range of motion, strength, points of tenderness, and signs of impingement or mechanical symptoms (snapping, catching, locking) were noted during physical examination. Patients were assessed for signs of FAI, acetabular version, dysplasia, and Tönnis osteoarthritis grade through the use of a series of preoperative radiographs (standing and supine anteroposterior pelvis, false-profile, modified Dunn, and cross-table lateral). Magnetic resonance arthrography (MRA) was used to diagnose intra-articular injuries such as labral tears and chondral damage. Before being recommended for surgery, all patients had pain that interfered with activities of daily living for ≥3 months and failed to improve with activity modification, nonsteroidal antiinflammatory drugs, cortisone injections, and physical therapy. All patients were counseled on the risks of continued running after hip arthroscopy.

Surgical Techniques

All candidates for hip arthroscopy had failed a minimum of 3 months of conservative measures such as rest, physical therapy, and injection and underwent preoperative assessment that included physical examination, radiographic evaluation, and magnetic resonance imaging (MRI). Hip arthroscopy was performed with the patient under general anesthesia on a traction table in the supine position. The hip joint was accessed with modified anterior, anterolateral, and distal anterolateral accessory portals by using an interportal capsulotomy. Diagnostic arthroscopy was performed in all patients, which included a Seldes classification of labral tears, acetabular labrum articular disruption (ALAD),[17] and Outerbridge grades for any chondral damage, assessment of the ligamentum teres, and noting of any other intra-articular pathology. Labral tears were addressed with repair, debridement, or reconstruction. The majority of labral debridement procedures occurred in the early portion of the study period as the senior author's surgical techniques before shifting to labral repair and reconstruction. Repair is currently the first choice of labral tear treatment. The indications for

Table 1. Patient Characteristics

Characteristics	Basketball (n = 31)	Control (n = 31)	*P* Value
Sex, n (%)			>.999
Female	11 (35.5)	11 (35.5)	
Male	20 (64.5)	20 (64.5)	
Age at time of surgery, y	30.0 ± 12.2 (55.1-13.8)	30.1 ± 12.1 (55-14.1)	.949
Body mass index	26.3 ± 6.4 (43.5-18)	26.0 ± 5.4 (42.8-18.7)	.865
Duration of symptoms, mo	18.2 ± 12.3 (8.0-36.0)	25.8 ± 46.1 (2.0-240.0)	.019*
Follow-up time, mo	45.9 ± 21.6 (87.6-11.9)	55.4 ± 24 (96.3-3.5)	.141
Future secondary arthroscopy, n (%)	4 (12.9)	5 (16.1)	>.999
Time, mo	13.9 ± 5.5 (21.3-8)	13.0 ± 4.3 (17.9-8.2)	.807
Future conversion to THA, n (%)	3 (9.7)	4 (12.9)	>.999
Time, mo	36.1 ± 7.4 (41.4-30.9)	35.8 ± 7.1 (43.7-29.6)	.962
Complications, n (%)	1 (3.2)	2 (6.4)	>.999

NOTE. Values are given as mean ± SD (range), unless otherwise indicated.
THA, total hip arthroplasty.
*Statistically significant ($P < .05$).

labral reconstruction were absent/insufficient labral tissue for repair. Full-thickness chondral defects were treated with microfracture, and iliopsoas fractional lengthening was indicated in patients with frequent painful internal snapping and/or iliopsoas impingement. In addition, beginning in late 2010, capsular repair or plication was performed in patients with concerns of instability such as acetabular undercoverage or soft tissue laxity.

Recovery and Rehabilitation

Each patient was placed in a hip brace that protected against abduction and flexion past 90° and used crutches with 20-lb flatfoot weightbearing on the operative extremity for ≥2 weeks postoperatively. In most cases, physical therapy began the day after surgery, with a focus on restoring the patient's athletic function. Motion was continued postoperative day 0 or 1 with a stationary bike or continuous passive motion for 6 weeks. Patients were given permission to return to sport-specific training after completion of 3 months of physical therapy and demonstration of adequate gluteal/core strength with single leg squat/exercises. Return to cutting/pivoting and competition occurred at 6 months. Patients who underwent microfracture were restricted to crutches for 8 weeks and delayed physical therapy until 6 weeks after surgery. One patient who underwent labral reconstruction wore the brace and used crutches for 6 weeks and delayed physical therapy for 6 weeks.

Statistics

All statistical analyses were performed in Microsoft Excel (Microsoft Corporation; Redmond, WA) with the RealStatistics add-in package. Continuous variable distributions were tested for normality with the Shapiro-Wilk test. Based on this result, either a 2-tailed *t* test or a nonparametric equivalent was used for comparison, with paired versions when applicable. Statistical significance was set at $P = .05$.

Results

Demographics

There were 38 patients eligible for inclusion in this study. Of the 38, 31 patients (81.6%) had complete follow-up at an average of 46.8 months after surgery. Their mean age was 30.0 years, and their mean body mass index was 26.3. There were more male patients (64.5%) than female patients (35.5%) in the study group. These data are summarized in Table 1.

All 31 patients were successfully matched with control subjects. Significant differences were not observed for any demographic factors between the study group and the control group. A majority of the players (54.8%) identified themselves as recreational athletes, whereas the remainder competed at the high school, collegiate, amateur, or professional level. "Amateur" was defined as a patient who participated in organized competitions on an unpaid rather than a professional basis (e.g., tournaments, games). A flow chart illustrating the patient selection process is given in Figure 1, and the competition levels of the study group are shown in Figure 2.

Intraoperative Findings and Procedures

All patients were intraoperatively found to have labral tears. There were 19 patients (61.3%) who had ALAD and acetabular Outerbridge grades of ≥2 and 6 patients (19.4%) who had femoral head Outerbridge grades of ≥2. There were 13 patients (41.9%) with ligamentum teres tears. There were no significant differences between groups in regard to type of labral tear, chondral damage, and ligamentum teres tears. The most common procedure performed was femoroplasty (83.9%), followed by acetabuloplasty (77.4%), capsular release (71.0%), and labral repair (61.3%). The only significant difference between groups was that patients in the study group had significantly more removal of loose bodies (19.4% vs 0%) than the control group

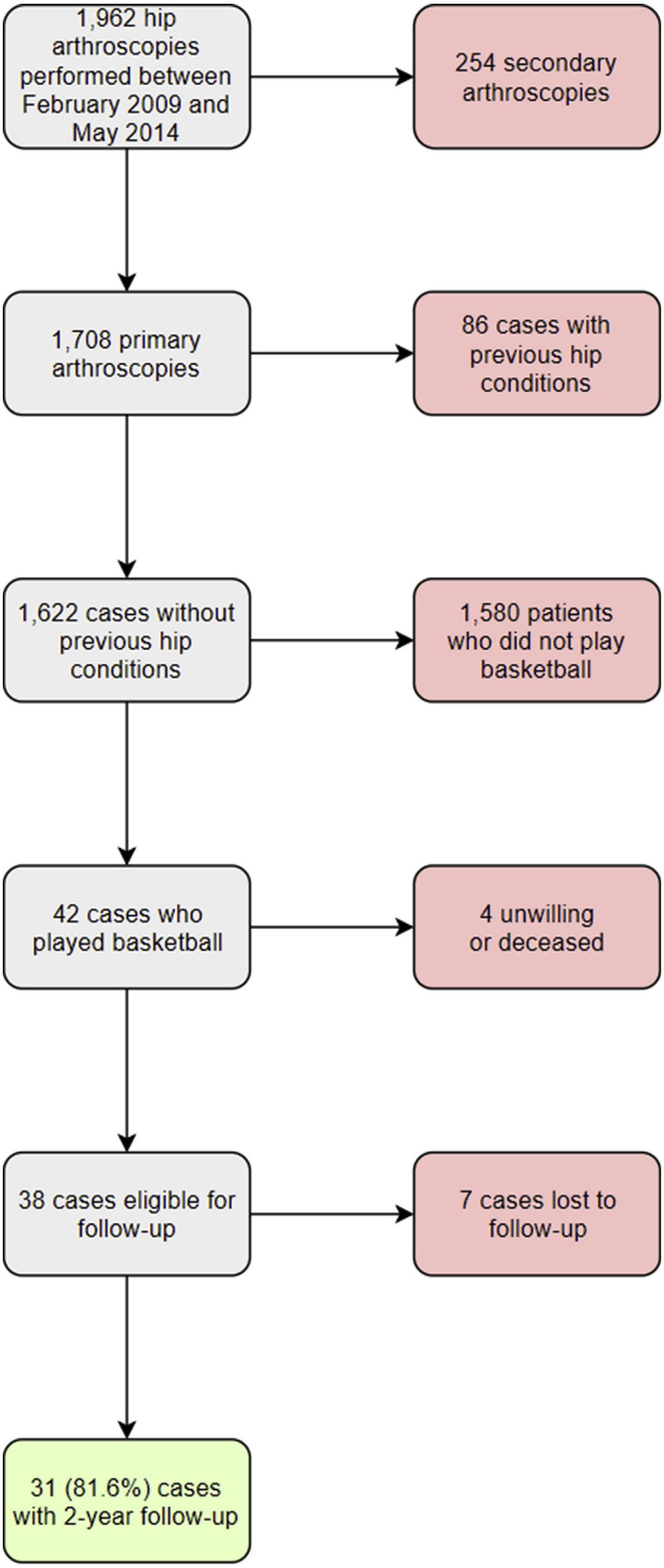


Fig 1. Patient selection flowchart.

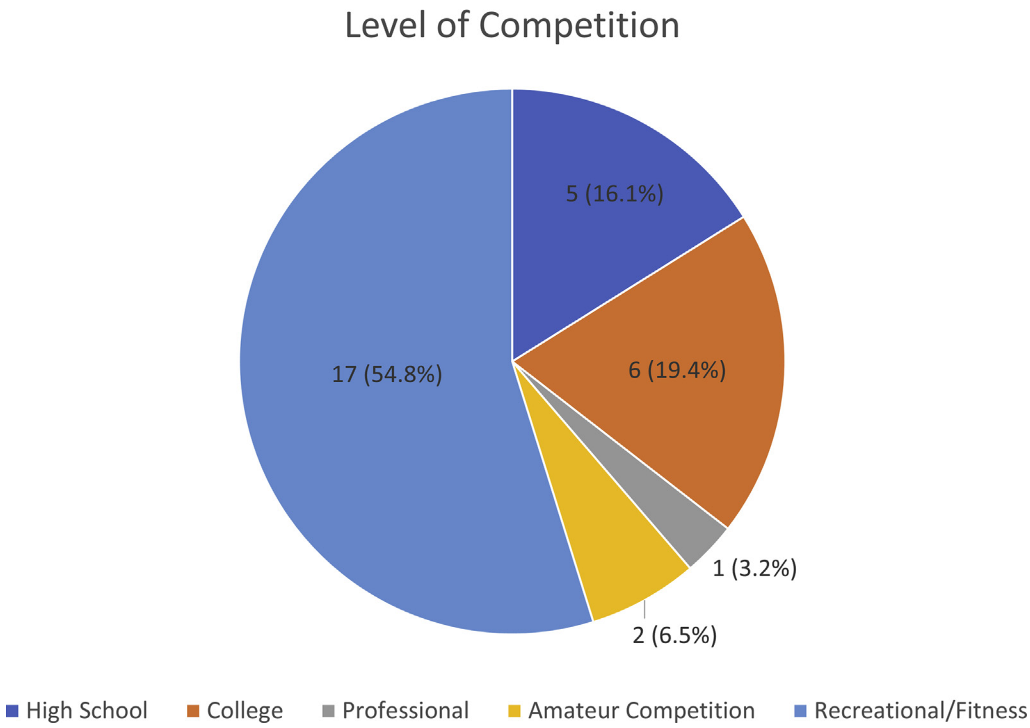


Fig 2. Level of competition.

(*P* = .024). All intraoperative findings and procedures are given in Tables 2 and 3.

Radiographic Findings

Preoperative and postoperative radiographic measures are given in Table 4. No significant differences were found in radiographic measures between the basketball group and the control group.

Patient-Reported Outcomes

There was a significant (*P* < .001) improvement in all PRO measures and VAS from the baseline preoperative

Table 2. Intraoperative Findings

Intraoperative Finding	Basketball (n = 31)	Control (n = 31)	*P* Value
Labral tear, n (%)			.126
Seldes I	11 (35.5)	19 (61.3)	
Seldes II	8 (25.8)	5 (16.1)	
Seldes I and II	12 (38.7)	7 (22.6)	
ALAD, n (%)			.479
0	4 (12.9)	3 (9.6)	
1	8 (25.8)	7 (22.6)	
2	5 (16.1)	9 (29.0)	
3	8 (25.8)	10 (32.3)	
4	6 (19.4)	2 (6.5)	
Acetabular Outerbridge, n (%)			.350
0	4 (12.9)	2 (6.4)	
1	8 (25.8)	8 (25.8)	
2	6 (19.4)	10 (32.3)	
3	5 (16.1)	8 (25.8)	
4	8 (25.8)	3 (9.7)	
Femoral head Outerbridge,n (%)			.114
0	25 (80.6)	30 (96.7)	
1	0	1 (3.2)	
2	1 (3.2)	0	
3	4 (12.9)	0	
4	1 (3.2)	0	
Ligamentum teres tear, n (%)			.585
Partial	12 (38.7)	16 (51.6)	
Complete	1 (3.2)	1 (3.2)	

ALAD, acetabular labrum articular disruption.

Table 3. Procedure Performed

Procedure	Basketball (n = 31)	Control (n = 31)	*P* Value
Labral treatment, n (%)			.270
Repair	19 (61.3)	24 (77.4)	
Debridement	11 (35.5)	7 (22.6)	
Reconstruction	1 (3.2)	0	
Capsular treatment, n (%)			.170
Release	22 (71.0)	16 (51.6)	
Repair/plication	9 (29.0)	13 (41.9)	
Acetabuloplasty, n (%)	24 (77.4)	24 (77.4)	>.999
Femoroplasty, n (%)	26 (83.9)	24 (77.4)	.749
Acetabular microfracture, n (%)	6 (19.4)	2 (6.4)	.255
Chondroplasty, n (%)	5 (16.1)	7 (22.5)	.749
Subspine decompression, n (%)	1 (3.2)	0	>.999
Notchplasty, n (%)	1 (3.2)	1 (3.2)	>.999
Loose body removal, n (%)	6 (19.4)	0	.024*
Iliopsoas fractional lengthening, n (%)	11 (35.5)	16 (51.6)	.200
Synovectomy, n (%)	3 (9.7)	5 (16.1)	.707

*Statistically significant ($P < .05$).

to minimum 2-year follow-up scores for both the basketball group and the control group. Baseline scores were similar for the 2 groups. At the most recent follow-up, the mean iHOT-12 for the basketball group was 73.7, and patient satisfaction was 8.1. Among the patients who did not convert to total hip arthroplasty (THA), 22 patients (78.6%) and 23 patients (82.1%) achieved the PASS of mHHS ≥74 and HOS-SSS ≥75, respectively. Twenty-one patients (75.0%) and 17 patients (60.7%) had an MCID of a change in mHHS ≥8 and in HOS-SSS ≥6, respectively.[18] Seven patients (26.9%) and 9 patients (34.6%) did not achieve PASS for mHHS and HOS-SSS, respectively, but were able to RTS. Seven patients (26.9%) and six patients (23.1%) did not achieve MCID for mHHS and HOS-SSS, respectively, but were able to RTS. In the control group, 17 patients (63.0%) and 13 patients (48.1%) achieved PASS for mHHS and HOS-SSS respectively, whereas 19 patients (70.4%) achieved MCID for mHHS and HOS-SSS. Outcomes data are shown in Figure 3.

Reoperations and Complications

In the basketball group, 4 patients (12.9%) required secondary arthroscopy at a mean of 13.9 months after their index procedure. Two patients developed painful internal snapping after their index procedure, which was treated with iliopsoas fractional lengthening. Another patient underwent reoperation to remove

Table 4. Radiographic Measures

Radiographic Measurements	Basketball (n = 31)	Control (n = 31)	*P* Value
Tönnis grade, n			>.999
Preoperative (0:1)	22:9	23:8	
Postoperative (0:1)	22:9	23:8	
Joint space, lateral, mm			
Preoperative	43.0 ± 10.5 (27 to 66)	44.5 ± 10.5 (27 to 75)	.571
Postoperative	40.3 ± 10.8 (25 to 68)	43.1 ± 11.2 (27 to 75)	.325
Joint space, medial, mm			
Preoperative	40.4 ± 9.9 (23 to 64)	37.3 ± 10.9 (21 to 81)	.252
Postoperative	40.9 ± 11.5 (19 to 67)	37.4 ± 10 (22 to 73)	.216
Lateral center-edge angle, °			
Preoperative	30.3 ± 6.2 (19 to 44)	30.9 ± 4.6 (22 to 42)	.660
Postoperative	28.7 ± 6.3 (18 to 42)	28.8 ± 5.5 (15 to 45)	.983
Acetabular inclination, °			
Preoperative	4.0 ± 4.6 (−4 to 12)	4.8 ± 4.3 (−4 to 17)	.515
Postoperative	4.1 ± 5 (−8 to 13)	5.1 ± 4.6 (−3 to 16)	.423
Neck shaft angle, °			
Preoperative	134.4 ± 5.9 (120 to 152)	133.2 ± 5.3 (120 to 143)	.412
Postoperative	132.5 ± 5.3 (123 to 145)	132.4 ± 4.9 (124 to 142)	.899
α Angle, °			
Preoperative	65.3 ± 12.8 (42 to 90)	63.2 ± 12.6 (42 to 83)	.541
Postoperative	44.5 ± 6.1 (29 to 57)	43.9 ± 7.7 (32 to 63)	.739
Femoral ateversion, °	13.6 ± 9.3 (−7 to 32)	8.3 ± 10.8 (−9.9 to 33)	.093

NOTE. Values are given as mean ± SD (range), unless otherwise indicated.

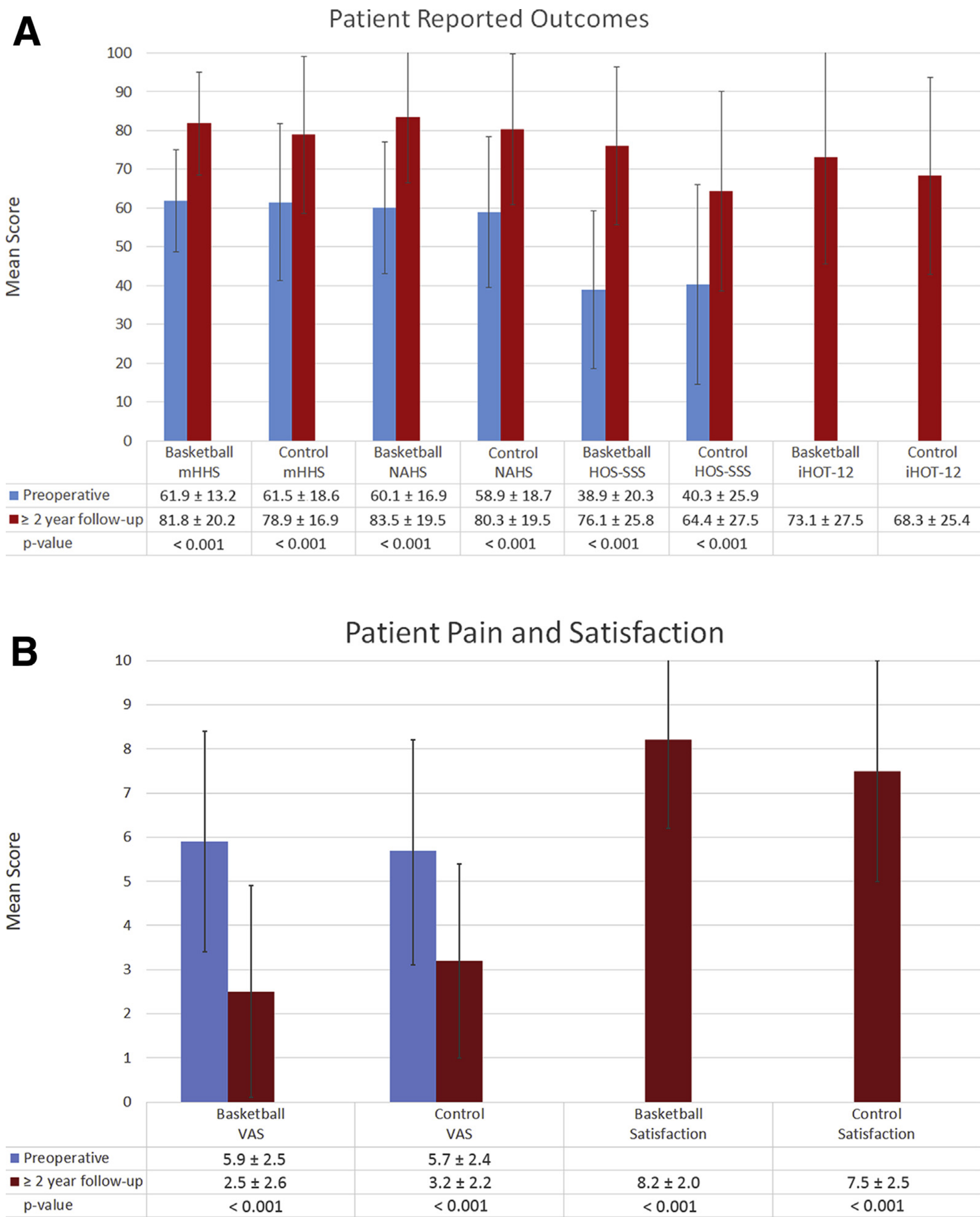


Fig 3. (A) Patient reported outcomes at preoperative and minimum 2-year follow-up. (B) Patient pain and satisfaction at preoperative and minimum 2-year follow-up.

heterotopic ossification. The fourth patient hadan insidious recurrence of pain after undergoing labral debridement and improved after undergoing labral repair during secondary arthroscopy. In the study group, 5 patients (16.1%) required a revision arthroscopy at a mean of 13.1 months after their index surgery. Two patients redeveloped labral tears due to injury. One patient developed a new labral tear in a different location. Another patient had a labral re-tear, likely due to residual pincer impingement. The fifth patient had recurrence of pain, which improved after being treated with labral debridement in the revision arthroscopy. Neither the rate ($P = .806$) nor the occurrence ($P > .999$) of secondary arthroscopy differed between the groups.

Three patients (9.7%) in the basketball group converted to THA at a mean of 35.9 months after arthroscopy. Notably, these patients were aged 41.5, 45.8, and 55.1 years, for an average age of 47.5 years, which is statistically significantly ($P = .023$) higher than the mean age of the study group. Based on the age of the youngest patient who converted to THA, 23 patients <40 years old were compared with the 8 patients >40 years old. The odds ratio for converting to THA after arthroscopy in patients ≥40 years old participating in basketball compared with patients <40 years was

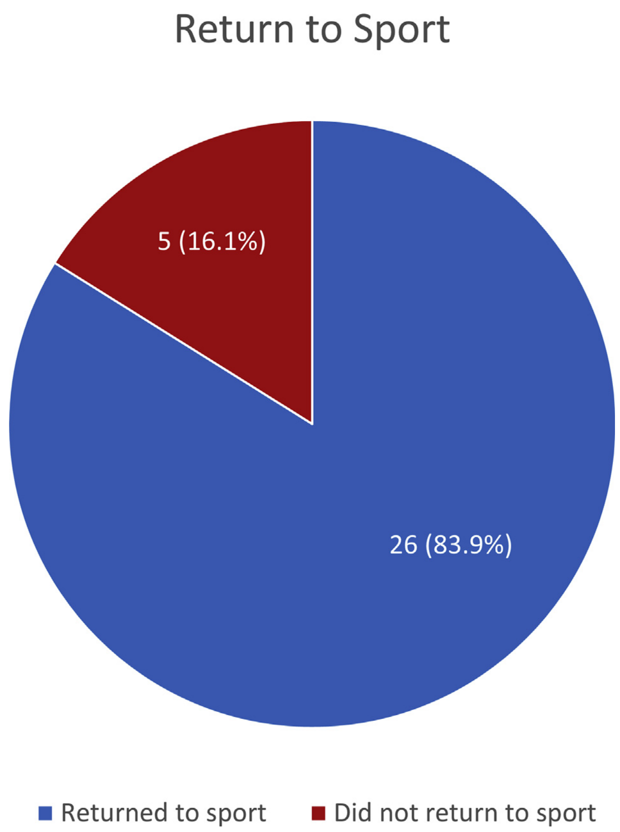


Fig 4. Percent of patients who returned to sport.

29.9 (95% confidence interval 1.3-667.4; $P = .033$). In the control group, 4 patients (12.9%), aged 34.6, 38.2, 49.6, and 51.2 years (mean age 43.4 years), converted to THA at a mean follow-up of 41.5 months after surgery. This was not a significantly different rate of conversion ($P > .999$) than that of the basketball group.

In the study group, the only postoperative complication was 1 case (3.2%) of numbness in the operative leg, proximal to the knee, that resolved after 1 year. The reason for the numbness was unknown. In the control group, there were 2 complications (6.4%): a case of deep vein thrombosis and another case of superficial infection that resolved after treatment with antibiotics.

Return to Sports

As shown in Figure 4, 26 patients (83.9%) had returned to playing basketball at the most recent follow-up. In addition, 23 patients (74.2%) subjectively reported their ability level as being the same or higher (Figure 5). Fourteen of the 17 recreational athletes, 1 of the 2 amateur athletes, 5 of the 6 collegiate athletes returned, 5 of the 5 high school athletes, and the only professional athlete RTS. The outcome measures at the most recent follow-up for the 5 patients who did not return to basketball were compared with the remainder of the patients who did and are summarized in Figure 6. The patients who did not RTS had significantly lower mHHS (63.8 vs 86.0, $P = .039$), NAHS (63.0 vs 88.6, $P = .008$), HOS-SSS (42.1 vs 84.0, $P = .001$), and iHOT-12 (43.5 vs 81.3, $P < .001$). They had a higher VAS score (6.0 vs 1.7, $P = .002$). The mean satisfaction for patients who did not return to basketball was 6.4 vs 8.5 in those who did return ($P = .050$). The odds ratio for meeting PASS in athletes who returned to basketball compared with those who did not return was 7.1 (95% confidence interval 0.9-57.5) ($P = .065$).

Discussion

At the most recent follow-up, all PROs and VAS scores significantly improved compared with baseline scores, and there was high patient satisfaction in basketball players who underwent hip arthroscopy. Twenty-two patients (78.6%) and 23 patients (82.1%) achieved PASS for mHHS and HOS-SSS, respectively. Twenty-one patients (75.0%) and 17 patients (60.7%) had an MCID between preoperative and postoperative PROs for mHHS and HOS-SSS, respectively. The secondary arthroscopy rate was 12.9%, conversion to THA rate was 9.7%, and the complication rate was 3.2%. In addition, 83.9% of patients resumed playing basketball after arthroscopy with an ability level maintained or improved in 74.2% of patients.

Basketball requires prolonged running, cutting, and jumping activities that are risk factors for the development of FAI.[19] Bony deformities of the femur and acetabulum subject them to abnormal axial, rotational,

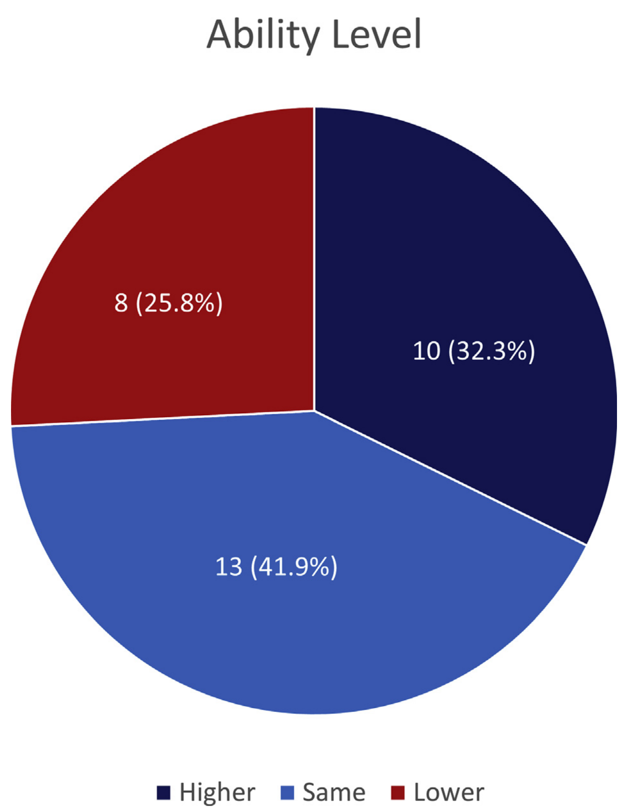
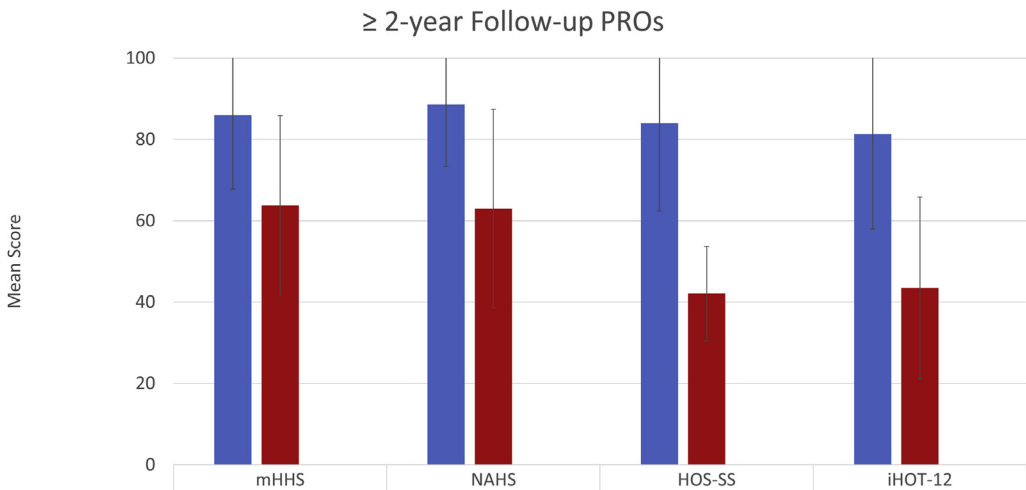


Fig 5. Ability level preoperatively compared to postoperatively.



	mHHS	NAHS	HOS-SS	iHOT-12
Returned to sport	86.0 ± 18.2	88.6 ± 15.3	84.0 ± 21.6	81.3 ± 23.3
Did not return	63.8 ± 22.1	63.0 ± 24.4	42.1 ± 11.6	43.5 ± 22.3
p-value	0.039	0.008	0.001	< 0.001

Fig 6. Patient reported outcomes at minimum 2-year follow-up for patients who returned to sport and did not return to sport.

and torsional forces, resulting in pain and disability. Untreated FAI not only may prevent athletes from RTS but also is a risk factor for early progression to osteoarthritis.[20,21] Our data can be used to help guide basketball players and surgeons considering hip arthroscopy so they are aware of the overall outcomes and likelihood of RTS.

Multiple studies have examined RTS in athletes of all sports and competition levels after hip arthroscopy. The outcomes of basketball athletes are comparable to the results of participants in various other sports after hip arthroscopy. A review by Casartelli et al.[2] that included >1000 athlete hips treated surgically for FAI demonstrated 82% RTS at the same level with no difference seen between patients receiving open vs arthroscopic techniques. Malviya et al.[22] showed a 90% RTS rate in high school athletes, an 88% RTS rate in professional athletes, and a 73% RTS rate in recreational athletes at 1.4-year follow-up (range 1.4-1.8 years). We demonstrated an RTS level of 50% in amateur athletes (1 of 2), 82% in recreational athletes (14 of 17), 83% in collegiate athletes (5 of 6), and 100% in high school athletes (5 of 5).

In our mixed population of recreational, collegiate, and professional basketball players, we showed an RTS rate of 83.9%. This rate is comparable to previously reported RTS rates in other athletic populations. In addition. 74% of athletes returned to the same level of play.

Basketball is a sport that requires significant cutting and jumping maneuvers, which may make RTS at the same level more difficult compared with activities such as swimming or cycling, which place lower demands on the hip joint. Also, the decision to RTS is multifactorial with self-motivation, aging, pain, encouragement from others, and adapting to physical limitations all playing important roles in the ultimate decision.[23] Our study included a significant proportion of recreational athletes, who are more likely to change their activity level from higher-demand to lower-demand activities, especially if this is recommended by their surgeon.[24] Studies that have larger proportions of professional athletes will likely have higher rates of RTS at the same level of competition, because this population has limited windows of play and considerable socioeconomic considerations that may influence their outcomes.[2,25,26] For many of these reasons, RTS is an imperfect measure of surgical success; in the future, more objective measurements of athlete performance, such as sprint times or jumping abilities, should also be evaluated.

Several PROs were obtained preoperatively and postoperatively to determine the degree of improvement after surgery. Our results are comparable to those of previously reported studies in other athletes. Weber et al.[15] showed increases in mHHS scores from 60.5 to 78.9 ($P < .001$) in recreational athletes and from 58.8 to 78.3 in high-level athletes ($P < .001$). In their mixed population of competitive and recreational runners, Levy et al.[18] showed increases in mHHS from 62.0 to 79.7 ($P < .01$) and in HOS-SSS from 47.7 to 83.7 ($P < .001$). Brunner et al.[27] demonstrated an increase in NAHS from 54.4 to 85.7 at a mean of 2.4 years in a mixed population of athletes. Domb et al.[13] showed that PROs were higher in patients who successfully RTS compared with those who were unable to return: mHHS scores (86.1 RTS vs 78.4 no RTS), NAHS (86.0 RTS vs 76.8 no RTS), and VAS scores (1.59 RTS vs 3.35 no RTS). Our athletes who were unable to RTS also had statistically lower PROs: mHHS scores (63.8 vs 86.0,

P = .039), NAHS (63.0 vs 88.6, P = .008), HOS-SSS (42.1 vs 84.0, P = .001), and iHOT-12 (43.5 vs 81.3, P < .001) compared with those who were able to RTS.

Our study showed a complication rate of 3.2%, which is similar to prior studies.[28-30] This rate is based on the retrospective review of reported complications; however, specific questioning of complications was prospectively recorded at each follow-up. Three of our patients required conversion to THA after an average follow-up period of 3 years; these patients were significantly older (41.5, 45.8, and 55.1 years) than the study group (average 30.0 years), which may have contributed to their need for conversion. Patients ≥40 years of age participating in basketball were 30 times more likely to convert to THA after arthroscopy than were those <40 years old. This suggests that surgeons should use extra caution when considering hip arthroscopy in this patient population and that these patients should be counseled on the risk conversion to THA after hip arthroscopy.

The athletes included in this study are a mixed group of all competition levels of basketball. Though the sample size is small, these data could be referenced when considering surgical treatment in this athletic population with respect to postoperative expectations and chances of RTS. Athletes should be cautioned that despite surgery, they may not be able to RTS or may return at a lower level of activity.

Strengths

Our study has several strengths. First, we used a mixed competition-level population of basketball players. Second, we followed patients for a minimum of 2 years after surgery while we collected data on PROs and RTS. Additionally, all procedures were completed by a single surgeon, thereby minimizing variability in results.

Limitations

This study has the inherent limitations of a retrospective comparative study. The study group is limited to patients who indicated participation in basketball, a possible selection bias. Responses about sport-related abilities were also self-reported, a possible source of reporting bias. A single surgeon performed all procedures on a specific group of patients, which may limit the study's generalizability. Furthermore, there was a variety of treatments performed (varying labral treatments, capsular treatments, microfracture, osteoplasties, etc.) and patients (age and level of competition). which limits the ability to determine the factors that were important in outcomes. The use of RTS as a measure of surgical success is a difficult outcome to measure, given the many factors that influence it. We also did not record if patients who did not return to basketball participated in lower-impact activities. Because of the use of a relatively small sample size in order to study a specific patient population, it is possible that this analysis was underpowered to detect certain differences, particularly within the player group. For example, in the comparison between players who did and those who did not RTS, the close approaches to statistical significance in satisfaction and odds ratio for reaching the PASS suggest potential type II error. In addition, the frequency of playing basketball before surgery and after surgery was not collected. Patients were asked to assess their level of sport, but this level could have varied between patients, with some playing the sport more or less frequently. Also, there was a lack of data on the divisions at which the collegiate athletes played. Finally, we agree that not all patients who do not RTS constitute failures; we did not obtain follow-up sufficiently comprehensive to comment on the precise reason for these patients' decisions to not RTS.

Conclusions

Hip arthroscopy in basketball athletes demonstrates a significant increase in PROs, high RTS rate, and low risk of complications. Hip arthroscopy may be considered in basketball players <40 years old for whom nonoperative treatment failed and who have a significantly limited level of play. Careful patient selection and counseling may be used when considering hip arthroscopy in basketball players >40 years old as there may be a high rate of conversion to THA.

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