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Epidemiology of Hip Injuries in the National Basketball Association

A 24-Year Overview

Timothy J. Jackson,[*†] MD, Chad Starkey,[‡] PhD, AT, FNATA, Danielle McElhiney,[‡] MS, AT, and Benjamin G. Domb,[*§||¶] MD

Investigation performed at American Hip Institute, Westmont, Illinois, USA

Background: Professional athletes are subject to various injuries that are often dictated by the nature of their sport. Professional basketball players previously have been shown to sustain injuries throughout the musculoskeletal system, most commonly to the ankle and knee.

Purpose: The purpose of this study was to report the epidemiology of injuries specific to the pelvis, hip, and thigh and their effect on games missed in professional basketball players.

Study Design: Descriptive epidemiological.

Methods: Records were recalled from the National Basketball Association epidemiological database for athletic-related pelvis, hip, or thigh injuries that occurred from the 1988-1989 through the 2011-2012 seasons. The primary information collected included anatomic location where the injury occurred, when in the course of the season injury occurred, specific pathology, date, activity at the time of injury, injury mechanism, number of practices and games missed, and whether surgery was required. The number of practices and games missed were summed to yield the number of days missed per episode.

Results: There were 2852 cases (14.6% of all athletic-related injuries) involving 967 individual players. In 1746 (61.2%) cases, injuries occurred during game competition. Across the course of this study, clinical incidence of injury to the pelvis, hip, or thigh was 1.50 per 100 players. The mean ($\pm$standard deviation) number of days missed per case was 6.3 $\pm$ 10.2. The quadriceps group was the most commonly injured structure (contusions and strains) and had a significantly higher game-related injury rate than other structures (0.96 per 100 athletic exposures, 95% confidence interval [CI] = 0.87-1.04). Players had the greatest risk (relative risk = 1.38, 95% CI = 1.26-1.52) of sustaining a strain than any other type of injury, with a game-related injury rate of 1.79 (95% CI = 1.67-1.90). The hamstring muscle group was the most frequently strained. Strains were more likely to occur in the preseason.

Conclusion: Pelvis, hip, and thigh injuries in professional basketball players are commonly extra-articular strains and contusions and represent a significant burden of injury. The actual amount of intra-articular hip disorders may be underestimated, as the awareness of these disorders has increased only in the past decade. With the awareness of the types of injuries that occur in this region, focused injury prevention strategies may be beneficial to players and teams at all levels of competition, not only professional athletes.

Keywords: basketball; hip; injury; strain

Basketball was originally designed to be a noncontact sport, yet the evolution of the game has progressed significantly since its creation in 1891. From aggressive, low post play to high-flying dunks, the physical nature of the game has become extremely aggressive. With the type of sport it has become and the grueling length of each season, one would naturally expect injuries to result.

Although there is a heightened understanding of intra-articular hip pathology, most athletic-related injuries to the hip are extra-articular.[1,3,8] Drakos et al[6] demonstrated that 11.5% of all injuries in professional basketball players were related to the hip, with the majority of these being muscle strains and contusions. Prevention, in addition to treatment, of injuries in all sports is widely studied.[9,10,13,16] Awareness of the types of injuries that affect a given sport and identifying risk factors associated with injury is the first step in prevention, with strategies aimed at lessening the burden of the most common injuries. Identifying epidemiological injury factors to the anatomic joints associated with participating in a specific sport will assist in the prevention of future injuries and perhaps increase the longevity of a player's sporting career.

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The purpose of this study was to examine the incidence and risk factors of various injuries to the pelvis, hip, or thigh and how these injuries affect player participation in games. Our hypothesis was that there will be a significant burden of injury from the pelvis, hip, and thigh region, with most injuries from extra-articular sources.

METHODS

We recalled records from the United States National Basketball Association (NBA) epidemiological database for athletic-related pelvis, hip, or thigh injuries that occurred from the 1988-1989 through the 2011-2012 seasons. For the purposes of this study, we defined the pelvis, hip, and thigh as the ilium, ischium, pubic, or sacrum; the femoral head, neck, and proximal shaft; muscles acting on the coxofemoral joint; the quadriceps muscle group (including the sartorius), hamstrings, abductors, and adductors; and any neurovascular structures within this area. Injuries to the quadriceps, hamstring, and adductors were all included as these muscle groups span the hip joint. Hamstring and adductor tears have been shown to be predominately proximal and constitute injury about the hip rather than the knee.[11,12]

Each team submitted monthly reports for injuries, illnesses, or other conditions. The criteria for a reportable injury were defined as any injury that required physician intervention, resulted in at least 1 practice or game being missed, or resulted in emergency care being rendered. Data were submitted using a standardized league-wide instrument that was completed by the team's athletic trainer. Player demographic information (permanent identification code, position, height, weight, age, number of years of playing experience, and number of games and minutes played) was recorded annually.

The primary information collected included the player's identification number, when and where the injury occurred, specific pathology, and the date, activity at the time of injury, and injury mechanism. We also collected data regarding the number of practices and games missed and whether surgery was required. The number of practices and games missed were summed to yield the total number of days missed per episode.

Statistical Analysis

Frequencies, descriptive statistics, risk, clinical incidence, and game-related incidence rates were calculated using Microsoft Excel 2010 (Microsoft, Redmond, Washington, USA). Game-related injury rates were calculated using 1000 athletic exposures (AEs; 1 player appearing in 1 game equals 1 AE, 12 players appearing in 1 game equals 12 AEs); player risk was calculated per 100 players. Because of the lack of a consistent and reliable method of calculating practice and preseason game exposures, incidence rates for participation in these activities were not calculated. The total (practice and game) frequency, percentage of total injury, risk, and descriptive statistics for time lost were calculated. To identify differences in game-related injury rates, the 95% confidence interval (CI) was calculated for variables having at least 10 game-related cases. The unpaired Student t test was used to determine significance in differences between groups of players with and without injury (Table 1).

TABLE 1
Player Demographic Information[a]

	All Players (n = 1898)	Injured Players (n = 967)
Age, y	24.4 ± 4.4	27.2 ± 4.0
NBA experience, seasons	4.0 ± 4.2	5.2 ± 3.8
Height, cm	200.61 ± 9.50	199.67 ± 9.80
Mass, kg	100.64 ± 13.39	99.46 ± 13.42

[a]Values are expressed as mean ± standard deviation. NBA, National Basketball Association.

RESULTS

During the 24 years (seasons) covered in this study, 1898 players appeared on an NBA roster and accounted for 8729 player seasons (Table 1). These players appeared in 511,214 regular and postseason games (AEs) and totaled 12,316,586 minutes played. A total of 25,539 cases were reported during the study period, of which 19,565 (76.6%) were athletic related. Our query identified 2852 cases (14.6% of all athletic-related cases) involving 967 individual players. Participation in game competition accounted for 1746 (61.2%) injuries.

The clinical incidence of injury to the pelvis, hip, or thigh was 1.50 per 100 players. The game-related injury rate was 3.26 per 1000 AEs. A total of 17,933 days (practices and/or games) were missed, representing an average of 747 days lost per season; the mean (±standard deviation) number of days missed per case was 6.3 ± 10.2. The quadriceps group was the most commonly injured structure and had a statistically significant game-related injury rate compared with other structures (0.96 per 100 AEs; 95% CI = 0.87-1.04) (Table 2). Strains caused an average of 7.4 days missed versus 3.3 days missed for contusions.

Players had the greatest risk (relative risk [RR] = 1.38, 95% CI = 1.26-1.52; $P < .05$) and game-related injury rate (1.79 per 100 AEs; 95% CI = 1.67-1.90; $P < .05$) of sustaining a strain than any other type of injury (Table 3). The hamstring muscle group was the most frequently strained, but these metrics were not significantly higher than the adductor group (Table 4). Approximately 40% of strains were the result of dynamic overload/eccentric contractions. Strains were most frequent in the first month of the season (the preseason), representing more than double the number that occurred in any other month (Figure 1). This is, in part, because of the increased roster size during the preseason. The greatest risk of strains occurred during the player's eighth year in the league, and the cumulative risk showed a significant increase with length of career (Figure 2). Demographically, players who sustained a strain held a relative risk of 0.76 of sustaining at least 1 additional strain across the course of their playing career (95% CI = 0.69-0.83; $P < .05$) (Table 5). Over the 24-year course of the study, the rate of injury did not show a significant increase (Figure 3).

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TABLE 2
Injury Detail by Structure[a]

	All Cases						Game-Related Cases		
	n (%)	Injured Players	Clinical Incidence	Risk	Days Missed (%)	Days Missed, Mean ± SD	n (% of Area)	Rate	95% CI
Quadriceps[b]	716 (25.1)	450	0.38	0.24	2612 (14.6)	3.7 ± 5.3	490 (68.4)	0.96	0.87-1.04
Group	537 (75.0)	368	0.28	0.19	1760 (67.4)	3.3 ± 5.0	361 (67.2)	0.71	0.63-0.78
Rectus femoris	65 (9.1)	57	0.03	0.03	298 (11.4)	4.6 ± 5.5	41 (63.1)	0.08	0.06-0.10
Vastus lateralis	56 (7.8)	52	0.03	0.03	279 (10.7)	5.0 ± 6.6	45 (80.4)	0.09	0.06-0.11
Vastus medialis	40 (5.6)	39	0.02	0.02	124 (4.7)	3.1 ± 5.2	30 (75.0)	0.06	0.04-0.08
Sartorius	16 (2.2)	14	0.01	0.01	126 (4.8)	7.8 ± 6.3	11 (68.8)	0.02	0.01-0.03
Vastus intermedialis	2 (0.3)	2	0.00	0.00	25 (1.0)	12.5 ± 9.2	2 (100.0)	0.00	
Hamstrings	691 (24.2)	428	0.36	0.23	6528 (36.4)	9.5 ± 12.9	365 (52.8)	0.71	0.64-0.79
Group	460 (66.6)	319	0.24	0.17	4098 (62.8)	8.9 ± 10.6	228 (49.7)	0.45	0.39-0.50
Biceps femoris	166 (24.0)	127	0.09	0.07	1713 (26.2)	10.3 ± 17.8	98 (59.0)	0.19	0.15-0.23
Semimembranosus	44 (6.4)	40	0.02	0.02	556 (8.5)	12.6 ± 13.7	26 (59.1)	0.05	0.03-0.07
Semitendinosus	21 (3.0)	19	0.01	0.01	161 (2.5)	7.7 ± 7.8	12 (57.1)	0.02	0.01-0.04
Adductor group	623 (21.8)	385	0.33	0.20	4016 (22.4)	6.45 ± 7.4	371 (59.6)	0.73	0.65-0.80
Group	500 (80.3)	320	0.26	0.17	3209 (79.9)	6.4 ± 7.4	291 (58.2)	0.57	0.50-0.63
Adductor magnus	51 (8.2)	46	0.03	0.02	263 (6.5)	5.2 ± 5.0	30 (58.8)	0.06	0.04-0.08
Adductor longus	44 (7.1)	39	0.02	0.02	388 (9.7)	8.8 ± 8.6	30 (68.2)	0.06	0.04-0.08
Gracilis	12 (1.9)	10	0.01	0.01	71 (1.8)	5.9 ± 5.4	7 (58.3)	0.01	
General adductor	8 (1.3)	8	0.00	0.00	43 (1.1)	5.4 ± 6.8	6 (75.0)	0.01	
Adductor brevis	8 (1.3)	8	0.00	0.00	42 (1.0)	5.3 ± 4.1	7 (87.5)	0.01	
Hip	333 (11.7)	255	0.18	0.13	1576 (8.8)	4.7 ± 8.6	214 (64.3)	0.42	0.36-0.47
General hip flexor	124 (37.2)	105	0.07	0.06	524 (33.2)	4.2 ± 6.5	74 (59.7)	0.14	0.11-0.18
General hip	100 (30.0)	92	0.05	0.05	233 (14.8)	2.3 ± 3.8	80 (80.0)	0.16	0.12-0.19
Greater trochanter	58 (17.4)	53	0.03	0.03	351 (22.3)	6.1 ± 9.1	37 (63.8)	0.07	0.05-0.10
Iliopsoas	24 (7.2)	23	0.01	0.01	184 (11.7)	7.7 ± 11.3	9 (37.5)	0.02	0.01-0.03
Other hip muscle	16 (4.8)	15	0.01	0.01	117 (7.4)	7.3 ± 10.3	10 (62.5)	0.02	0.01-0.03
Sciatic nerve	6 (1.8)	6	0.00	0.00	69 (4.4)	11.5 ± 20.9	1 (25.0)	0.00	
Inguinal ligament	3 (0.9)	3	0.00	0.00	97 (6.2)	32.3 ± 36.9	0 (0.0)	0.00	
General hip nerve	2 (0.6)	2	0.00	0.00	1 (0.1)	0.5 ± 0.7	2 (100.0)	0.00	
Pelvis	180 (6.3)	154	0.09	0.08	708 (3.9)	3.9 ± 8.0	132 (73.3)	0.26	0.21-0.30
Ilium	138 (76.7)	102	0.07	0.05	511 (72.2)	3.7 ± 8.1	107 (77.5)	0.21	0.17-0.25
Pubic bone	27 (15.0)	24	0.01	0.01	164 (23.2)	6.1 ± 9.2	14 (51.8)	0.03	0.01-0.04
Ischium	15 (8.3)	15	0.01	0.01	33 (4.7)	2.2 ± 2.4	11 (73.3)	0.02	0.01-0.03
Sacrum	178 (6.2)	143	0.09	0.08	1058 (5.9)	5.9 ± 10.9	110 (61.8)	0.22	0.17-0.26
Sacroiliac joint	121 (68.0)	102	0.06	0.05	731 (68.4)	6.0 ± 10.2	58 (47.9)	0.11	0.08-0.14
General sacrum	39 (21.9)	35	0.02	0.02	177 (16.6)	4.5 ± 9.5	35 (89.7)	0.07	0.05-0.09
Coccyx	12 (6.7)	12	0.01	0.01	36 (3.4)	3.0 ± 2.5	12 (100.0)	0.02	0.01-0.04
Sacral bone	6 (3.4)	6	0.00	0.00	114 (10.8)	19.0 ± 28.3	5 (83.3)	0.01	
Gluteals	71 (2.5)	65	0.04	0.03	297 (1.7)	4.2 ± 5.2	43 (60.6)	0.08	0.06-0.11
Gluteus maximus	54 (76.1)	49	0.03	0.03	234 (78.8)	4.3 ± 5.4	33 (61.1)	0.06	0.04-0.09
Gluteus medius	11 (15.5)	10	0.01	0.01	55 (18.5)	5.0 ± 5.6	5 (45.5)	0.01	
Gluteus minimus	6 (8.5)	6	0.00	0.00	8 (2.7)	1.3 ± 1.0	5 (83.3)	0.01	
Coxofemoral	45 (1.6)	39	0.02	0.02	696 (3.9)	15.5 ± 19.5	15 (33.3)	0.03	0.01-0.04
Hip joint capsule	25 (55.6)	24	0.01	0.01	278 (39.9)	11.1 ± 15.9	10 (40.0)	0.02	0.01-0.03
Acetabulum	16 (35.6)	13	0.01	0.01	334 (48.0)	20.9 ± 21.6	3 (18.8)	0.01	
Femoral head	4 (8.9)	4	0.00	0.00	84 (12.1)	21.0 ± 29.7	2 (50.0)	0.00	
Other	15 (0.5)	15	0.01	0.01	442 (2.5)	29.5 ± 45.4	6 (40.0)	0.01	
Other muscle	10 (66.7)	10	0.01	0.00	140 (31.7)	14.0 ± 14.0	5 (50.0)	0.01	
Femoral shaft	5 (33.3)	5	0.00	0.00	302 (68.3)	60.4 ± 70.5	1 (20.0)	0.00	
Total	2852 (100)	967	1.50	0.51	17,933 (100.0)	6.3 ± 10.2	1746 (61.2)	3.42	3.26-3.58

[a]SD, standard deviation; CI, confidence interval.
[b]Includes sartorius.

The quadriceps muscle group had the highest risk of contusion (0.19 per 100 athletes; RR = 2.65, 95% CI = 2.20-3.20) and game-related injury rate (0.77 per 1000 AEs; 95% CI = 0.70-0.85) than all other body areas (Table 6). More than 70% of these injuries were caused by contact with another player, most commonly being kneed or kicked, representing 419 (45%) of the total number of contusions. Approximately 200 (26%) contusions were the result of athletes falling to the court.

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TABLE 3
Frequency of Injury by Type[a]

	All Cases						Game-Related Cases		
	n (%)	Injured Players	Clinical Incidence	Risk	Days Missed (%)	Days Missed, Mean ± SD	n (% of Area)	Rate	95% CI
Strain[b]	1633 (57.3)	732	0.86	0.39	12,109 (67.5)	7.4 ± 10.1	913 (55.9)	1.79	1.67-1.90
Contusion	940 (33.0)	528	0.50	0.28	3143 (17.5)	3.3 ± 5.7	728 (77.4)	1.42	1.32-1.53
Inflammatory	166 (5.8)	136	0.09	0.07	1705 (9.5)	10.3 ± 18.8	48 (28.9)	0.09	0.07-0.12
Sprain	98 (3.4)	81	0.05	0.04	637 (3.6)	6.5 ± 10.8	50 (51.0)	0.10	0.07-0.12
Fracture	10 (0.4)	10	0.01	0.01	279 (1.6)	27.9 ± 36.5	6 (60.0)	0.01	
Neuropathy	5 (0.2)	5	0.00	0.00	60 (0.3)	12.0 ± 23.5	1 (25.0)	0.00	
Total	2852 (100)	967	1.50	0.51	17,933 (100)	6.3 ± 10.2	1746 (61.2)	3.42	1.67-1.90

[a]SD, standard deviation; CI, confidence interval.
[b]Six cases of athletic pubalgia were classified as strains.

TABLE 4
Muscle Strains[a]

	All Cases						Game-Related Cases		
	n (%)	Injured Players	Clinical Incidence	Risk	Days Missed (%)	Days Missed, Mean ± SD	n (% of Area)	Rate	95% CI
Hamstring group	661 (23.2)	415	0.35	0.22	6354 (35.4)	9.6 ± 13.0	351 (53.1)	0.69	0.61-0.76
Multiple muscles	443 (15.5)	310	0.23	0.16	4001 (22.3)	9.0 ± 10.1	222 (50.1)	0.43	0.38-0.49
Biceps femoris	156 (5.5)	119	0.08	0.06	1647 (9.2)	10.1 ± 18.3	93 (59.6)	0.18	0.14-0.22
Semimembranosus	42 (1.5)	38	0.02	0.02	550 (3.1)	13.1 ± 13.8	24 (57.1)	0.05	0.03-0.07
Semitendinosus	20 (0.7)	18	0.01	0.01	156 (0.9)	7.8 ± 8.0	12 (60.0)	0.02	0.01-0.04
Adductor group	603 (21.1)	372	0.32	0.20	3911 (21.8)	6.5 ± 7.3	359 (59.5)	0.70	0.63-0.77
Multiple muscles	489 (17.1)	313	0.26	0.16	3167 (17.7)	6.5 ± 7.4	286 (58.5)	0.56	0.49-0.62
Adductor magnus	51 (1.8)	46	0.03	0.02	263 (1.5)	5.2 ± 5.0	30 (58.5)	0.06	0.04-0.08
Adductor longus	43 (1.5)	38	0.02	0.02	368 (2.1)	8.6 ± 8.5	29 (67.4)	0.06	0.04-0.08
Gracilis	12 (0.4)	10	0.01	0.01	71 (0.4)	5.9 ± 5.4	7 (58.3)	0.01	
Adductor brevis	8 (0.3)	8	0.00	0.00	42 (0.2)	5.3 ± 4.1	7 (87.5)	0.01	
Quadriceps group[b]	171 (6.0)	145	0.09	0.08	938 (5.2)	5.5 ± 6.2	91 (53.2)	0.18	0.14-0.21
Multiple muscles	104 (3.6)	88	0.05	0.05	491 (2.7)	4.7 ± 6.0	47 (45.2)	0.09	0.07-0.12
Rectus femoris	43 (1.5)	40	0.02	0.02	242 (1.3)	5.6 ± 5.7	27 (62.8)	0.05	0.03-0.07
Other	24 (0.8)	23	0.01	0.01	205 (1.1)	8.5 ± 8.6	17 (70.8)	0.03	0.02-0.05
Hip	152 (5.3)	128	0.08	0.07	681 (3.8)	4.5 ± 6.7	86 (56.6)	0.17	0.13-0.20
General hip flexor	119 (4.2)	101	0.06	0.05	479 (2.7)	4.0 ± 6.4	70 (58.8)	0.14	0.10-0.17
Iliopsoas	21 (0.7)	21	0.01	0.01	137 (0.8)	6.5 ± 8.5	8 (38.1)	0.02	
Other hip muscle	12 (0.4)	11	0.01	0.01	65 (0.4)	5.4 ± 5.8	8 (66.7)	0.02	
Other	40 (1.4)	35	0.02	0.02	176 (1.0)	4.4 ± 5.8	23 (57.5)	0.04	0.03-0.06

[a]SD, standard deviation; CI, confidence interval.
[b]Includes sartorius.

Sprains accounted for 98 (3.4%) of the total cases. The majority of these (n = 80, 81% of all sprains) involved the sacroiliac joint. Fifteen sprains (15%) involved the coxofemoral joint, including 3 labral tears.

There were 3 stress fractures, 4 avulsion fractures, 2 nondisplaced acute fractures, and 1 osteochondral defect of the femoral head. Twenty patients were reported to have undergone 22 surgeries—7 for herniations (4 abdominal hernias, 3 inguinal hernias, and 3 cases of athletic pubalgia). Surgery was required for 5 inflammatory cases, of which 2 surgeries were for labral tears, 2 for tendon rupture, and 1 for an avulsion fracture. Surgical cases accounted for 561 days missed, with a mean of 25.5 ± 35.7 per case. One case of femoral osteochondritis accounted for 158 days missed or 28% of the total time lost.

DISCUSSION

This study reports the prevalence of hip injuries in professional basketball players over 24 seasons. The results are consistent with previous epidemiologic studies regarding athletic injuries that demonstrated extra-articular muscle strains comprising the majority of injuries. With the anatomic and biomechanical nature of the hip,[1] there was little surprise that muscle strain was found to be the

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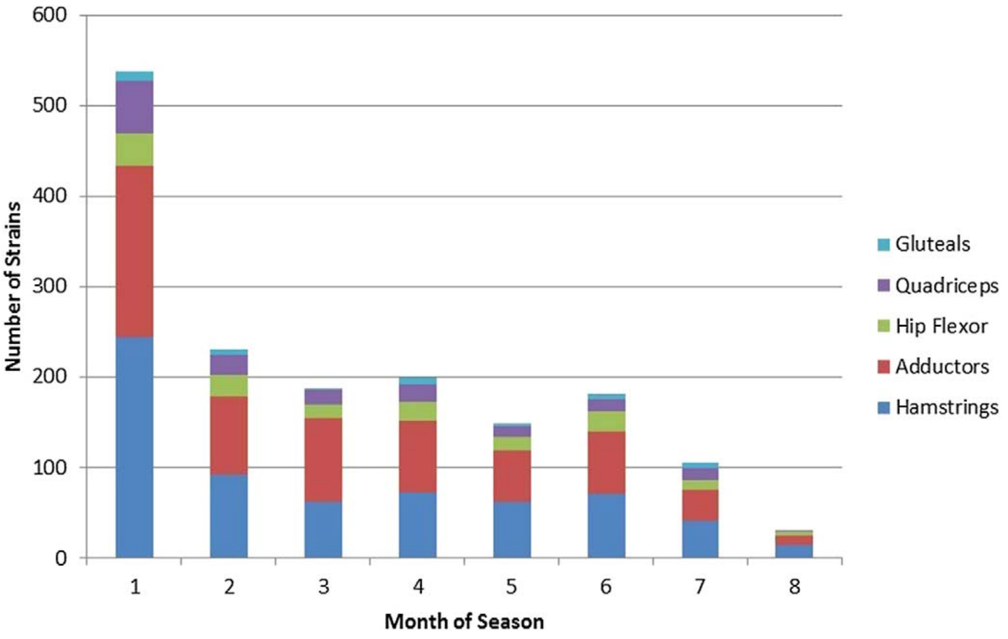

Figure 1. Frequency of strains by month of the season. Month 1 is the preseason. Two seasons were shorted because of labor disputes and did not span the entire 8 months.

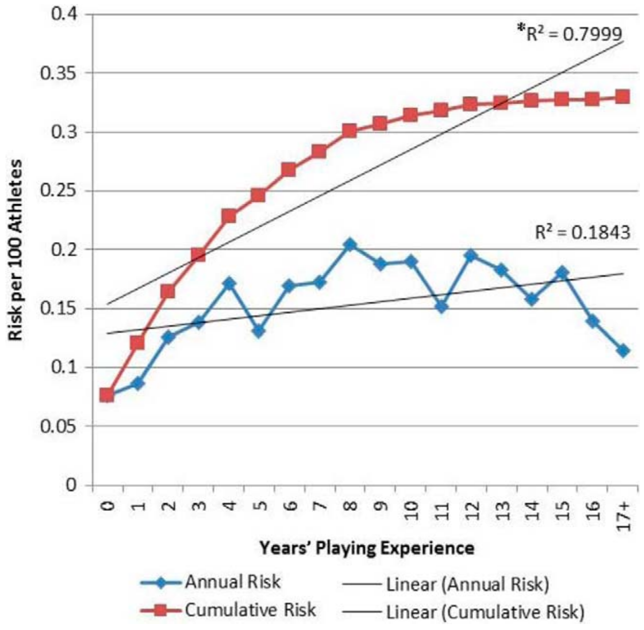

Figure 2. Annual and cumulative risk of hip strains by years of playing experience. Hernia-related strains were omitted from this calculation. There was a significant cumulative risk across a player's career (*$P < .0001$) . Risk per season was not significant.

most common injury to the pelvis, hip, and thigh in professional basketball players—especially for the 2-joint muscles.

In a previous study analyzing all types of injuries in professional basketball players, the most common injuries were lateral ankle sprains, accounting for 13.2% of all cases, and patella-femoral inflammation, accounting for 11.9%.[6] The incidence of hip injuries in this study (14.6% of all injuries) was consistent but slightly higher than other studies in basketball players, which showed a hip injury rate of 7% to 12.3% of all injuries.[4,6] Of the hip injuries in this study, 57.3% were strains and 33% were contusions related to contact with other players or the court. This increased proportion of strains has not been found consistently in studies of collegiate-level athletes.[5,14] This difference is likely multifactorial, with differences in the length of seasons between the 2 levels. A professional basketball team plays 82 games in a regular season, whereas a typical collegiate team will play 31 regular-season games. The longer season can predispose players to fatigue, with increased susceptibility to muscle strain.[9] Another explanation is the age of players,[2] which was shown to be a factor in this study as well.

When compared with National Football League (NFL) players, professional basketball players demonstrated a higher proportion of hamstring strain and adductor strain and a lower proportion of hip flexor strains.[8] In NFL

TABLE 5
Risk Factors for Injury to the Hip/Thigh/Pelvis for Professional Basketball Players

Risk factors for strain injury
Muscle imbalance
Increasing age
Previous strain
Early season

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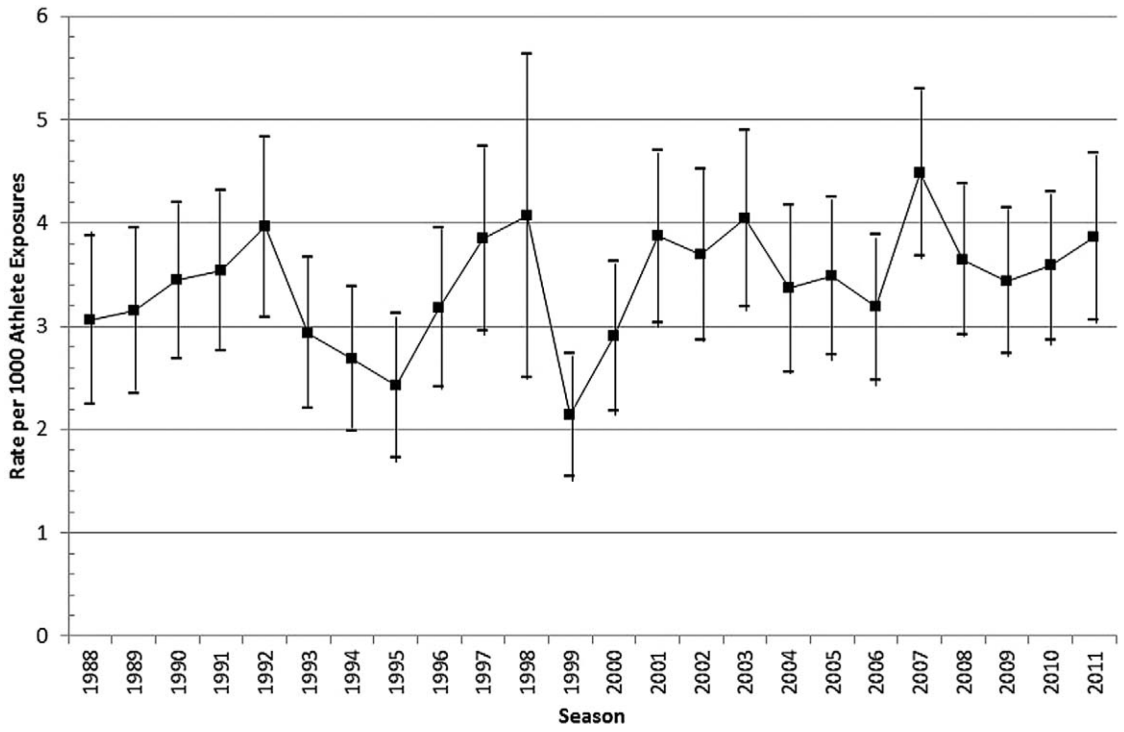

Figure 3. Rate of injury per 1000 athletic exposures across the study period. Over the course of the 24-year study period, the rate of injury was not statistically significant ($r^2 = 0.125$). Bars represent 95% confidence intervals.

TABLE 6
Contusions[a]

	All Cases						Game-Related Cases		
	n (%)	Injured Players	Clinical Incidence	Risk	Days Missed (%)	Days Missed, Mean ± SD	n (% of Area)	Rate	95% CI
Quadriceps	530 (18.6)	361	0.28	0.19	1556 (8.7)	2.9 ± 4.4	395 (74.5)	0.77	0.70-0.85
Pelvis	153 (5.4)	136	0.08	0.07	550 (3.1)	3.6 ± 7.8	122 (79.7)	0.24	0.20-0.28
Hip	129 (4.5)	110	0.07	0.06	454 (2.5)	3.5 ± 5.9	106 (82.2)	0.21	0.17-0.25
Sacrum/coccyx	64 (2.2)	58	0.03	0.03	297 (1.7)	4.6 ± 8.4	60 (93.8)	0.12	0.09-0.15
Gluteals	40 (1.4)	38	0.02	0.02	173 (1.0)	4.3 ± 5.6	28 (70.0)	0.05	0.03-0.08
Other	24 (0.8)	24	0.01	0.01	113 (0.6)	4.7 ± 5.5	17 (70.8)	0.03	0.02-0.05

[a]SD, standard deviation; CI, confidence interval.

players, 63% of all strains were hip flexor, as compared with 9.3% in our study. Professional basketball players had a slightly higher incidence of hamstring and adductor strains relative to NFL players. Awareness of the most common injuries to affect professional basketball players can help with prevention of these injuries. Hamstring and adductor strains can be prevented by stretching and strengthening programs directed at these muscle groups. A study by Tyler et al[16] demonstrated a significant decrease in adductor strains in professional hockey players after completion of a preseason exercise program. These players were considered as high risk because of decreased strength and abduction range of motion. Similar findings have been shown in soccer and Australian rules football.[17,18] Identifying players who may be at risk for sustaining adductor or hamstring strains, such as players with previous strain or decreased range of motion, may be beneficial to prevention of injury.

The strength of this study is the 24-year span of data collection that yields a large amount of data from which to analyze injury prevalence. This strength is also part of its limitation. Awareness of intra-articular disorders such as femoroacetabular impingement and labral tears has increased substantially over the past decade, and some disorders that were classified as strain earlier during this study may have been diagnosed as a labral tear if assessed today. This is demonstrated by the statistics of only 2 surgical cases for labral tears and 15 cases of coxofemoral sprain. This could be a limitation of the database itself, since off-season surgery can be excluded from data collection, or a

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limitation in the awareness of or the ability to detect intra-articular hip disorders. We considered evaluating the data prior to 2003 and after 2003, but with the low numbers of labral tears reported, this would not have contributed to the analysis. A study of intra-articular hip injuries in hockey players from the National Hockey League had 94 intra-articular hip injuries over 4 seasons from 2006 to 2010.[7] Although there is a well-documented incidence of hip injuries in hockey players,[15] the increased incidence noted in that cohort could be accounted for by the more recent dates for data collection. Some authors have suggested that adductor strain with rectus strain can occur in the setting of labral tears in what has been called the "sports hip triad."[8] The current study demonstrated a high number of adductor strains. With a clinical awareness of this association and current heightened suspicion for labral tears and femoroacetabular impingement, perhaps more labral tears will be diagnosed as NBA seasons progress.

CONCLUSION

Pelvis, hip, and thigh injuries in professional basketball players are commonly extra-articular strains and contusions and represent a significant burden of injury. The actual amount of intra-articular hip disorders may be underestimated, as the awareness of these disorders has increased only in the past decade. With the awareness of the types of injuries that occur in this region, injury prevention strategies focused on these may be beneficial to players and teams at all levels of competition, not only professional-level athletes.

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